VILNIUS GEDIMINAS TECHNICAL UNIVERSITY

Dovilė LAZAUSKAITĖ

QUALITY ANALYSIS AND INTEGRATED ASSESSMENT OF RESIDENTIAL ENVIRONMENT OF DEVELOPING SUBURBAN SETTLEMENTS

DOCTORAL DISSERTATION

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CIVIL ENGINEERING (02T)

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Abstract

While planning an expansion of Lithuanian villages, appropriate methodology is lacking of quality assessment of populated areas, which would allow evaluating the connection between cities and rural suburban areas. It is needed as the changes are affecting both the one and the other functionality. The opportunity to rectify appropriate indicators and potential residents' opinions would allow improving the quality assessment of rural and urban environments. This therefore would allow reaching better future decisions in terms of strategic territorial planning.

The objective of the research – the quality of the suburban rural residential areas in terms of its functionality, spatial organization (living environment) and its contribution while formatting the network of suburban rural areas.

The aim of the research – to improve general quality of the plans for urban and rural residential areas including the assessment of interaction level between the urban and rural areas systems.

This doctoral thesis consists of these parts: introduction, three chapters, conclusions and the list of used literature including the list of the author's publications on this topic. The first chapter is devoted to the literature review. Previous studies which are relevant to the chosen topic were overviewed in this part of the paper. The second section is devoted to the creation of the integrated quality assessment model of conceptual urban and rural living environment. The objective indicators and subjective views of potential residents are combined in this model. The third chapter is devoted to the conceptual model's practical application, there multi-criteria model called TOPSIS_A was used in rural areas which are located next to the main Lithuanian cities: Vilnius, Kaunas and Klaipeda. TOPSIS_A was used in order to evaluate the quality of the development and living environment in the rural areas which are located in suburbs of the major cities. Based on the results of the evaluation, potential development plan was created for the residential suburban areas. The scenario, which was based on the assessment of development of rural residential areas, was compared with current demographical trends and the metropolitan areas master plans.

The author of this research has written ten scientific articles about the results of this research. Two of them were published in scientific journals which are refereed in Thomson Reuters Web of Knowledge (ISI Web of Science) database; another two were published in international conferences' publications refereed in Thomson Routers database Proceedings; two articles in other international databases of scientific publications and four were published in other scientific publications.

Reziumė

Planuojant gyvenviečių plėtrą Lietuvoje, trūksta gyvenamosios aplinkos kokybės vertinimo metodikos, įvertinančios miestų ir šalia jų esančių kaimiškųjų teritorijų ryšius, įtakojančius tiek vienų, tiek kitų funkcionalumą. Galimybė suderinti objektyvius rodiklius ir subjektyvią potencialių gyventojų nuomonę leistų pagerinti miesto ir kaimo gyvenamosios aplinkos kokybės vertinimą priimant racionalesnius teritorijų planavimo sprendimus.

Tyrimo objektas – priemiestinių kaimiškųjų gyvenamųjų vietovių funkcinės, erdvinės organizacijos (gyvenamosios aplinkos) kokybė ir jos įtaka formuojant priemiestinių kaimiškųjų vietovių tinklą.

Darbo tikslas – pagerinti miestų ir kaimiškųjų gyvenamųjų vietovių bendrųjų planų rengimo kokybę, įtraukiant miesto ir kaimiškųjų vietovių sistemos sąveikos įtakos vertinimą.

Disertaciją sudaro įvadas, trys skyriai, bendros išvados, literatūros ir autoriaus publikacijų disertacijos tema sąrašai.

Pirmas skyrius skirtas mokslinių darbų disertacijos tema apžvalgai, esamai miesto ir kaimiškųjų gyvenamųjų vietovių sąveikos analizei Europoje ir Lietuvoje.

Antras skyrius skirtas konceptualiam miesto ir kaimo gyvenamosios aplinkos kokybės vertinimo integruotam modeliui sukurti, apjungt objektyvius rodiklius ir subjektyvią potencialių gyventojų nuomonę.

Trečias skyrius skirtas konceptualaus modelio eksperimentiniam taikymui, pasitelkiant daugiakriterinį TOPSIS_A metodą. Vilniaus, Kauno ir Klaipėdos miestų įtakoje esančių kaimiškųjų gyvenamųjų vietovių kokybinės plėtros įvertinimas pateikiamas sukurtų ateities plėtros scenarijų forma.

Konceptualaus modelio pagalba įvertinama didžiųjų miestų priemiesčiuose esančių kaimiškųjų gyvenamųjų vietovių gyvenamosios aplinkos kokybė.

Remiantis vertinimo rezultatais, kuriamas priemiesčio gyvenamųjų vietovių plėtros galimas vystymo scenarijus. Scenarijus palyginamas su esamomis demografinėmis tendencijomis bei didmiesčių rajonų bendraisiais planais grįsta priemiestinių kaimiškųjų gyvenamųjų vietovių plėtra.

Autorė atliktos analizės bei mokslinių tyrimų, susijusių su disertacijos tema rezultatus aprašė 10 mokslinių straipsnių: iš jų 2 publikuoti Thomson Reuters Web of Knowledge (ISI Web of Science) duomenų bazėse esančiuose žurnaluose, 2 straipsniai tarptautinių konferencijų leidiniuose, referuojamuose Thomson Reuters duomenų bazėje Proceedings, 2 straipsniai kitų tarptautinių duomenų bazių leidiniuose, 4 straipsniai kituose recenzuojamuose mokslo leidiniuose.

Notations

Symbols

A_h – affordability of housing;

A_l – affordability of plots of land;

α – selected significance level;

$\beta_0, \beta_1, ..., \beta_n$ – unknown constants;

c_i – sum of modified ranks;

c_{ik} – modified ranks;

C_S – development of a communication system;

C_{VS} – number of companies providing various services;

D_c – distance to the city centre;

d_i – normalised values of entropy weights;

E_i – entropy level of each index;

e_{ik} – ranks;

E_n – provision of dwelling with engineering networks;

ε – random error;

G_s – area of green planting per capita;

I_d – direct investment per capita;

i, j – alternatives;

K_{bita} – most accurate and possible inter-significance value of concerned solutions;

m_k – number of alternatives;

m – number of ranking criteria;

P_d – density of population;

$p_{intercept}, p_{v_1}, p_{v_2}$ – coefficients of the equation are statistically significant;

q_i – generalized weights;

r – number of experts;

R^2, R^2_{adj} – determination coefficient of the equation;

$\tilde{r}_{ij}$ – normalised values of indices;

S – sum of squared deviations;

T – value of the improvement/reduction pace of the ideal solution/negative ideal solution , %);

T_c – commuting time;

T_{fa} – inter-significance of the absolute accurate coefficient of the relevant alternatives;

T_{fs} – coefficient value determined in the final stage of decision making;

T_1 – value of the first alternative;

T_2 – value of the second alternative;

T_1', T_2' – reciprocal absolute importance values of two alternatives;

t – criterion for statistical significance of the coefficients check;

t_{ij} – element of calculated matrix indicates the absolute importance;

$VIF(\beta_i)$ – index of decreased dispersion;

ν – freedom degree;

ν_1 – distance to the city centre;

ν_2 – density of streets;

W – coefficient of concordance;

W_i – normalised entropy weights;

ω_1 – subjective weights of indices;

x_1 – feeling the noise generated by transport in the yard (perceived);

x_2 – heavy air pollution in the residential environment (perceived);

χ^2 – concordance criteria;

χ^2_{kr} – critical value;

Y – intentions to move to another place to live;

z_1 – population density of the district;

z_2 – traffic flow during the peak hour.

Abbreviations

DBS – Database system;

DG Regio – Directorate-General Regional Policy;

DG Agri – Directorate-General for Agriculture and Rural Development;

FOCI – Future Orientation for Cities;

EDORA – European Development Opportunities in Rural Areas;

EQLS – European Quality of Life Survey;

ESDP – European Spatial Development Perspective;

ESPON – European Territorial Observatory Network;

EU – European Union;

EUROSTAT – Directorate-General of the European Commission;

EU 12 – European Union of 12 member states: Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, United Kingdom;

EU 15 – European Union of 15 member states: EU 12 plus Austria, Finland, Sweden;

EU 27 – European Union of 27 member states: EU 15 plus Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, Bulgaria, Romania;

GDP – Gross domestic product;

HDI – Human Development Index;

LEADER – Links between the rural economy and development actions;

NRE – New Rural Economy;

OECD – Organisation for Economic Co-operation and Development;

RAIT – Market analysis and research group;

R Urban – Practices and Networks of Urban Resilience;

TOPSIS_A – Method of proximity to ideal point by the absolute mutual significance of single level of alternatives;

UK – United Kingdom;

UNDP – United Nations Development Programme;

USA – United States of America.

Contents

[1] The annexes are supplied in the enclosed compact disc.

Introduction

Problem formulation

They were formed in different periods of urbanization, have their own life cycles, and are the part of a complex state and regional socio-economic system and the part of its own public space. A creation, maturity and decline phases of urban or rural residential areas are natural processes. Indeed, many rural areas have attracted people and businesses through 'counter-urbanization' migration (Halfacree 2008). Rural areas have changed the role of food and fibre provider or recreational resource for city residents almost in all Europe. Rural areas are often characterized as having ageing population and selective out-migration, both of which further distort the demographic profile (Copus and De Lima 2014). Cities and rural areas are variable systems. Some rural areas are flourishing and boast a higher level of material prosperity, demographic and social vitality, than nearby cities. Many areas have experienced substantial restructuring of their economy, so that they increasingly have sectoral profiles rather similar to adjacent urban and traditional primary industries account for a small proportion of employment and value added (Copus and De Lima 2014). Researchers envisage serious concerns that rural broadband provision may exacerbate inequality (Grimes 2003; Malecki 2003; Warren 2007). All these changes challenge further distort even the territorial structure.

This reveals a need of rural-urban relationship resumption and recognition of gaps that we have done in measuring and describing quality of life conditions in areas that have been mostly affected by rural-urban interactions and its development potentials previously.

The author concludes that rural living environment is attractive but inconvenient and poor in terms of quality of the life. Qualitative rather than quantitative or territorial expansion has been highlighted as early as 2002 in Lithuanian territorial planning documents, however are difficult to implement both in rural and urban areas. Living environment which is created by the residents and their subjective opinions about quality of life in the long run becomes an urban issue.

Due to declining demographic resources a new approach is needed for intercommunication between urban and rural areas and synergies between these systems. The cities can't function appropriately without rural residential areas and vice versa. Therefore, balanced approach for both systems would be welcomed while looking for the best quality assessment model and residential areas expansion strategies in the previous researchers.

Relevance of the thesis

Over the past decade, population trends and demographic indicators have especially sensitively seen in Eastern Europe, which experienced a significant migration to other countries. Besides the implementation of EU structural funds, which were designed to improve the conditions of living in Lithuania, according to the current international forecasts the country will lose approximately 20% of its population by the years 2050. The main part of Lithuania is rural residential areas, where one-third of the whole country's population lives. It is obvious, that population decline will be significantly felt in these areas; therefore potential critical change may appear in the system and considerable confusion in the model of residential Lithuanian areas development and spatial structure.

Lithuanian population in rural areas has decreased by 9.5 percent in a period from 2008 till 2013. Although the rate of population decline was the same as in urban areas, the decline in rural areas was rapidly felt among young people who were under 15, while elder population over 65 years grew. These trends are also supported by the fact that approximately 1500 villages have disappeared from 2001 till 2011. The dramatic changes in rural areas have become a real issue.

Research object

The quality of the suburban rural residential areas in terms of its functionality, spatial organization (living environment) and its contribution while formatting the network of suburban rural areas.

Aim of the thesis

The aim of the research is to assess the interaction between urban and rural systems and to determine the impact on solutions of suburban residential areas development in urban planning documents.

Objectives of the thesis

So that to achieve the aim of the thesis, the following objectives have been defined:

1. Overview the connection between cities and its rural suburban settlements areas as they are influencing both one and the other functionality.
2. Define the concept of suburban residential environment including the connective components of rural and urban interaction. While measuring the quality of suburban residential environment, to evaluate the impact of connections.
3. To perform the analysis of internal migration of population between rural and urban settlements in the influence area of Lithuanian metropolitan cities.
4. Identify the factors both objective and subjective that are affecting the interaction between urban and rural residential areas and to develop the conceptual model of integrated assessment.
5. Furthermore, a conceptual model should be applied to rural residential areas which are located next to major Lithuanian cities. The results of the quality of expansion in residential areas should be presented together with the form of possible future scenarios.

Research methodology

The basic research methods were used in this study: theoretical, statistical, path analysis, experiential evaluation, multicriteria decision support method.

The literature review helped the author to disclose the main subject of this topic, overview the best practices of other countries while developing and applying the conceptual models in the past.

Internal migration of the residents and its causes were analysed using statistical methods. The path analysis was used in order to identify the key factors which are related to the object of this study.

The key factors were identified by the expert‘s evaluation and in this way the basis was formed for the conceptual model.

A rational qualitative expansion was created with a help of multicriteria decision support method and was compared with current demographic trends based on expansion of residential rural areas in suburbs.

Scientific novelty of the thesis

There are a lot of factors influencing a human’s quality of life in the cities: build and natural environment, mobility within the city, urban aesthetics, accessibility to services etc. How much these factors influence an urban sprawl and how to assess them more precisely still remains an open question. Some studies of quality of life are conducted at national level, some at regional level, but very few are conducted at a lower scale like neighbourhood or sub-city level, rather through the urban-rural interaction. Moreover, previous experience points to either only subjective or objective indexes used for evaluating the quality of life.

This research reflects on how the characteristics of economical and social environments, territorial development and ways of life through urban-rural interactions will possibly change in Lithuanian cities suburbs in the future. Thus, one of the major goals is to find a method for providing a subjective opinion with an objective form thus creating indexes that would have an impact on a general quality of life through variations in territory planning indicators.

Practical value of research findings

According to the obtained research finding the author of the present research is trying to convey a representative picture of development trends in contemporary largest Lithuanian cities’ districts, and propose the future development instrument for suburban rural settlements that reflects place-based assets and the

perceptions of individuals (both potential residents and planners of these settlements).

Defended statements

1. Cities and rural residential areas are not separate areas; they operate jointly in a complex socio-economic and in structural system of residential areas. Any critical change of the above mentioned systems may be crucial for the functioning of the other system.
2. The preparation of the general plans in Lithuania would improve if the influence assessment of the interaction between cities and rural areas systems had been included into their content.

Approval of research findings

The author of this dissertation has written ten scientific articles about the results of this research. Two of them were published in scientific journals which are refereed in Thomson Reuters Web of Knowledge (ISI Web of Science) database; another two were published in international conferences' – publications refereed in Thomson Routers database Proceedings; two articles in other international databases of scientific publications and four were published in other scientific publications.

Presentations in international scientific conferences/ congress:

1. Lazauskaitė, D. Quality Analysis of Vilnius City Suburban Spatial Development. 9th International Conference Environmental Engineering, May 22–23, 2014, Vilnius, Lithuania.
2. Lazauskaitė, D. The assessment of quality of life in sub peripheral urban areas. IV EUGEO Congress 2013, September 5–7, 2013, Rome, Italy.

Presentations in scientific conferences:

1. Levikovaitė L.; Lazauskaitė D. Gyvenimo kokybės vertinimas Vilniaus miesto pavyzdžiu. 16-oji Lietuvos Jaunųjų mokslininkų konferencija: Mokslas – Lietuvos ateitis, 2013 balandžio 11 d., Vilnius, Lietuva.
2. Lazauskaitė, D.; Palevičius V. Gyvenamųjų teritorijų sistemos plėtros modelio sukūrimas taikant diagnostinio sprendimų priėmimo metodą. Antroji jaunųjų mokslininkų konferencija. Fizinių ir technologijos mokslų tarpdalykiniai tyrimai, 2012 m. vasario 14 d., Vilnius, Lietuva.
3. Lazauskaitė D. Europos regionai. Respublikinė Civilinės inžinerijos ir geodezijos konferencija, 2011 m. spalio 21 d. Vilnius, Lietuva.

Presentations in conferences:

1. Lazauskaitė, D. Tarptautinės ESPON‘ 2013 programos patirties pamokos, plėtojant Lietuvos regionus. Konferencija. Lietuvos regionai: 10 metų Europos Sąjungoje, 2014 m. rugsėjo 11 d., Marijampolė, Lietuva.
2. Lazauskaitė, D. ESPON 2013: The European Observation Network of Territorial Development and Cohesion. International meeting of VISBY project: Capacity building in sustainable urban planning and development in Lithuania, Russia, Sweden and Ukraine, April 24, 2012, Vilnius, Lithuania.
3. Burinskienė M.; Lazauskaitė D. The development of regional planning in the Lithuania. Nordic-Baltic ESPON Conference for planners and policy-makers: Transnational perspectives on spatial planning-Experience from the Nordic-Baltic countries, February 4, 2011, Stockholm, Sweden.

Presentations in national forums:

1. Lazauskaitė, D. ESPON Europos miestų vizija 2020, 2030 ... . VIII Lietuvos urbanistinis forumas: Kompleksinis miestų modernizavimas, 2014 m. lapkričio 27 d. Šiauliai, Lietuva.
2. Burinskienė M.; Lazauskaitė D. ESPON duomenų taikymas sprendimų priėmimui po-kriziniu laikotarpiu. VII Lietuvos urbanistinis forumas. Miestas ir vanduo, 2013 m. spalio 25 d., Kaunas, Lietuva.
3. Lazauskaitė, D. Lietuva – Europos erdvinio planavimo tinkle. VI Lietuvos urbanistinis forumas. Šiuolaikiški miestai ir miesteliai: situacija, tendencijos, vizija, 2012 m. lapkričio 15 d. Vilnius, Lietuva.
4. Burinskienė, M.; Lazauskaitė, D. Tarptautinė ESPON programa 2013. V Lietuvos urbanistinis forumas. Lietuvos pajūrio urbanizacija. Patirtis. Pamokos. Vizija 2030, 2011 m. spalio 14 d. Klaipėda, Lietuva.

Structure of the thesis

Doctoral theses consists of introduction, three chapters, references, list of publications by the author on the topic of the dissertation, summary in Lithuanian.

The volume consists of 120 pages; 18 tables and 15 figures. The list of used literature including the list of the author’s publications on this topic consists of 162 scientific literature and other sources. A short description about the main parts and additions in the dissertation:

1. The review of urban-rural interaction changes and qualitative development perspectives in EU and Lithuania.

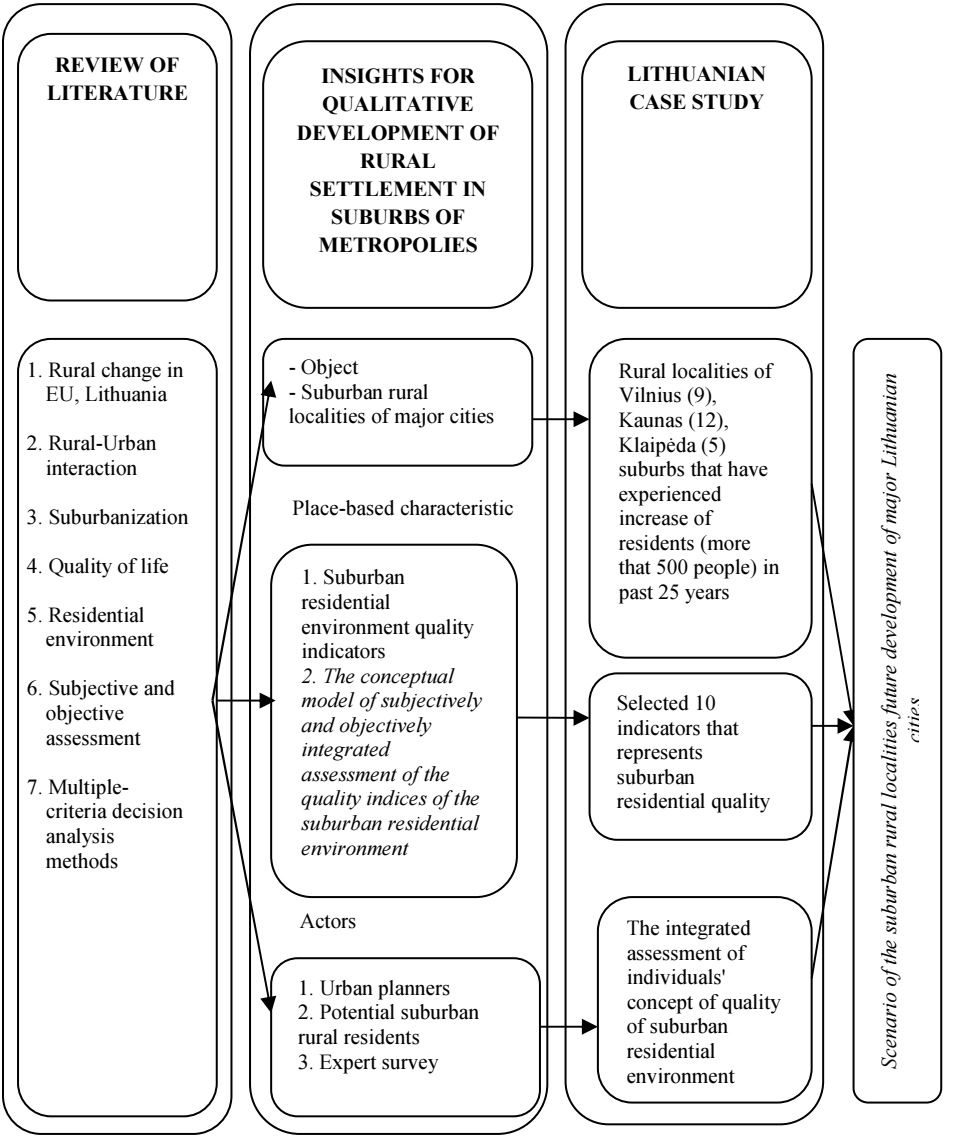

Fig. 1. Thesis plan

2. Creation of conceptual model of subjectively and objectively integrated quality indices assessment of the suburban residential environment.
3. Previous comparison of suburban settlements under the aspect of existing residential quality conditions and expected residential environment quality of potential residents.

Conclusions and the list of used literature including the list of the author's publications on this topic have been proposed at the end of thesis. The thesis plan has been reflected in Fig. 1.

1

Urban-rural interaction changes and qualitative development perspectives in European Union and Lithuania

In this chapter author focuses on literature review of urban-rural interaction changes and qualitative development perspectives in EU and Lithuania. An increase number of suburban city population, along with the tendency to move to the suburban city area, is a powerful incentive to perform research on measuring the level of sustainability and the quality of life in cities and suburban areas. There is a need to precisely define the quality of life in urban-rural interaction so that to properly evaluate and control it.

Based on results of this chapter 4 articles were published (Burinskienė *et al*. 2013, Lazauskaitė 2013, 2014, Lazauskaitė *et al.* 2015).

1.1. Rural-urban interaction importance in urban planning

The importance of rural-urban interaction in the context of European regional policy and spatial planning is traced to the European Spatial Development

Perspective (ESDP) of 1999 (Copus 2012). In the ESDP document urban and rural interaction was associated with the concept of 'polycentric development'.
The rising popularity of the urban-rural relationship concept among spatial planners and the Cohesion Policy community was paralleled by an increasing use of the term 'city region' in some EU member state context (Caffyn and Dahlstrom 2007; Rodriguez-Pose 2008), and by 'delocalization' and 'sustainable rural development' concepts among rural development academics (Marsden 2009).
European Commission interest in urban-rural interaction was reflected in a series of seminars, conferences in 2008–2009 and in 2011–2013 (Metz 2012, Warsaw 2013) a joint research initiative with the OECD, under the acronym of R-Urban. R-urban is a bottom-up strategy that demonstrates the perspective on rural areas. This strategy initiates locally closed ecological cycles that will support the emergence of alternative models of living, producing and consuming between the urban and the rural.
The EU sustainable development policy guidelines emphasize the necessity to foster functional linkages and partnership between urban-rural territories so reducing the differences of economic growth. This goal has been also included in European Spatial Development Plan, the Territorial Agenda 2020, the European Community Strategic Guidelines on Cohesion and etc.
Urban-rural interaction is characterized as visible and invisible human, capital, goods, information and technology flows, which include administrational and legal, financial and culture linkages between both territories (Kūle 2010) and the aim of which is cohesive spatial development and territorial socio-economic growth. The conceptual model of urban-rural interaction has been reflected in Fig. 1.1. – components of interaction and expected benefits have been included (Bulderberga 2014).

As it can be seen from the presented scheme, the basis of urban-rural interaction is composed from material and non-material flows between urban and rural areas. These flows create the basis for linkages. For instance, resident commuting from urban to rural areas or vice versa can cause economic or social linkages depending on the aim of commuting. Interaction can be promoted or, just the opposite, limited by the activity of administration both regarding the development of particular territory and the cooperation with neighbouring territories. Several significant benefits are obtained as a result of interaction, for example, public services are promoted, territory's potential is effectively used; as a result, the residents of both territories are beneficiaries (Bulderberga 2014).

When collecting the opinion of various authors, it must be concluded that there is no united understanding about the interaction of territories and its elements. Scientist emphasizes the positive role of interaction in the promotion of balanced spatial development and effective administration of both territories by characterizing different interaction elements and forms, for instance, resident migration.

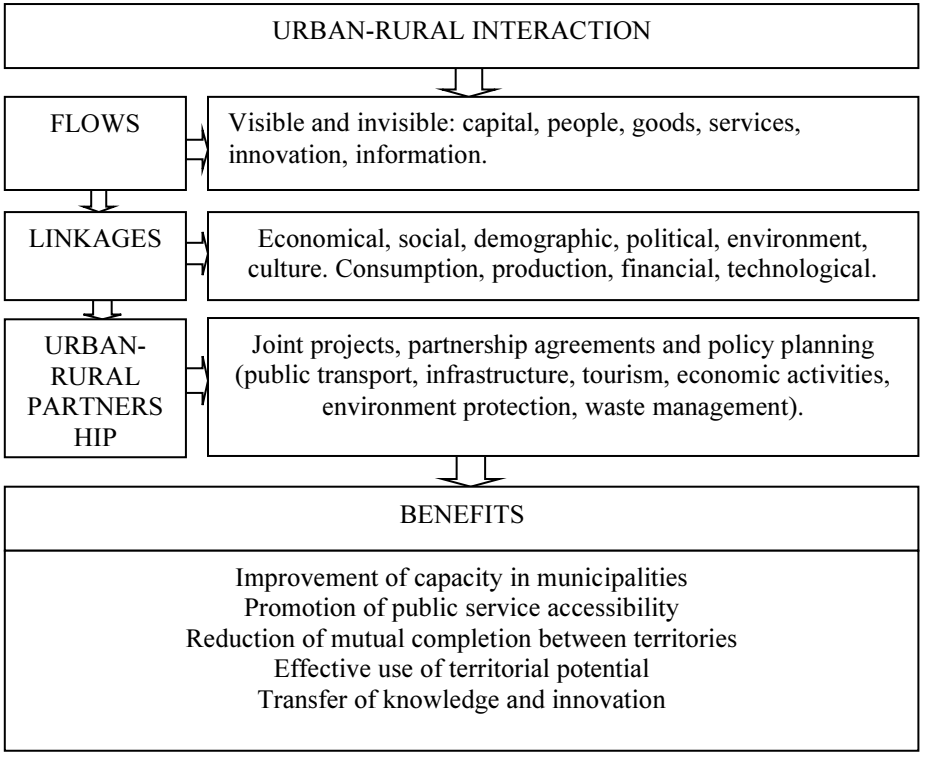

Fig. 1.1. Urban-rural interaction (Rondinelli and Ruddle 1978; Unwin 1989; Gaile 1992; Tacoli 1997; Douglass 1998; Adell 1999; Snoxell 2005; Smith 2009; Kūle 2010)

Material and nonmaterial flows between urban and rural areas are the basis of interaction's implementation – from urban to rural areas or vice versa – residents of the two territories commute, goods, and services are transported as well as different resources, which are an important element for the economics of particular country or region. Direction of flow or intensity characterizes the relationships of those territories.

Regional Policy Framework for 2013–2019 approved in 2013 is a planning document of average aim to create equivalent life and work conditions to all residents regardless of place of residence by promoting entrepreneurship in regions, developing qualitative transport and communication infrastructure and public services.

Urban to rural flow consists of two migration movements: suburbanization and counter-urbanization. These two migration movements have different scope and range and therefore also a different impact on the spatial organization of society (Šimon 2012).

A key challenge is to find a satisfactory way of distinguishing metropolitan spill over from other forms of deconcentration, but question also arise concerning the precise manner in which counterurbanisation should be recognized, including the specification of the variables involved and the scale at which the test should be applied (Champion 1989).

1.1.1. Change in European rural-urban interaction

Research confirms the continuation of rural depopulation in many parts of Europe, primarily driven by out-migration of young, often the most dynamic, adults (Machold et al. 2002; Stockdale 2006). It has been identified, that a total of seven categories of out-migrants based on their re-location decisions, with the largest group defined by 'career aspirers' re-locate to urban centres to access further and higher education (Stockdale 2006).

Counterurbanisation has also features across parts of Europe since the 1970s, as documented by Champion (1981) and others.

There is general agreement that rural restructuring in the post-productivism era has played a part in driving counter urbanization (Marsden 1998) and the phenomenon is widely reported to be associated with movements of middle class urban retirees, or commuters who continue to have their economic base in the city, motivated by the desire for a rural lifestyle.

Thus, many counter urbanites not only bring with them diverse urban networks but also represent a valuable source of human and social capital to rural communities. The process of counter urbanization has also been influenced the relocation of employment as firms have been able to take advantage of technological developments to seek a more congenial setting for their activities.

Lifestyles of 'country living' (facilitated by increasing car-based daily mobility) have increasingly substituted for labour-market conditions as push and pull factors that influence migration motives and priorities (Johansson and Persson 2000). Such migration has resulted in changes in the population structure of different types of locality with regard to age, gender and professions – all changes that have complex regional development implications.

The 'rural revival' in the USA and Western Europe has been associated with structural changes that were described as the New Rural Economy (NRE). Rural areas are all very different and exhibit differing development paths, associated with their location and economic structure. Many rural areas have been shown to 'outperform' urban areas in regard to demographic development, and they have been undergoing processes of transformation of their socio-economic structure and economic base, as well as their regional contexts and roles.

In many cases, the very notion of 'rurality' as a territorial quality has been challenged. These emerging areas have, in many ways, more in common with urban and densely populated districts and have taken advantage of the possibilities connected to the development towards the new rural economic

structure. They are often affluent regions characterized by accessibility, widespread commuting and growth. The NRE is, thus, both an effect of the structural transformation of the rural areas and a renewal of the population by in-migration of people who are often urbanized in a behavioral or mental sense – 'mental urbanization'. Even if the rural landscape can still be considered rural, ideas, jobs and habits have more in common with urban norms that the traditional rural values – and the prime driver behind this transformation is in-migration (Amcoff 2000, Phillips 2005; Westlund and Pichler 2006).

The development trends described above appear to be most relevant density populated rural areas close to big cities. The general tendency seems to be that rural areas in the vicinities of metropolitan areas and regional centres increase of population, whereas rural areas at the peripheries experience a decrease. Thus, the densely populated rural regions are in a more favorable position with regard to population change than other rural regions, and have also experienced relatively positive population development during the years around the turn of the century (Johansson 2005; Copus 2006). This has, at least, been the case in Sweden, but there are signs that this is also an accurate summation of the situation in many other Western European countries as well. Many studies have shown that young adults move from every type of rural area, whereas families frequently move to the countryside in the neighbourhood of the big cities (Weslund 2002; Westlund and Pichler 2006; Johansson 2011).

In particular, the development surrounding big cities in the UK and USA has been described in terms of rural gentrification and 'urbanization', symbolizing a transformation of rural communities to (upper) middle-class communities, with urban values and associated lifestyles (Cross 1990; Hall 1991; Phillips 2005).

In Eastern European countries, where regional income disparities are large, migratory movements are still primarily oriented towards the big cities, including those in the wealthier Western European Countries (Johansson 2009).

Various European (European Agricultural; Cohesion Policy) and national policies make distinctions between rural and urban. The key output of empirical analysis undertaken in ESPON 2013 project EDORA (European Development Opportunities for Rural Areas) was a set of three regional typologies relating to three dimensions of differentiation, rurality/accessibility. A new contribution in classifying European regions distinguishes predominantly rural, intermediate and predominantly urban regions.

The below presented typology has been developed over several years with participation of such European bodies as DG Regio, DG Agri and Eurostat. To well known OECD typology was added the factor of access or vicinity to urban centres.

The typology approach to identify population in urban areas consist of a population density threshold (300 inhabitants per sq. km.) applied to grid cells of 1 sq. km. and a minimum size threshold (5000 inhabitants) applied to grouped

grid cells above the density threshold. The population living in rural areas is the population living outside the urban areas identified through methods described above.

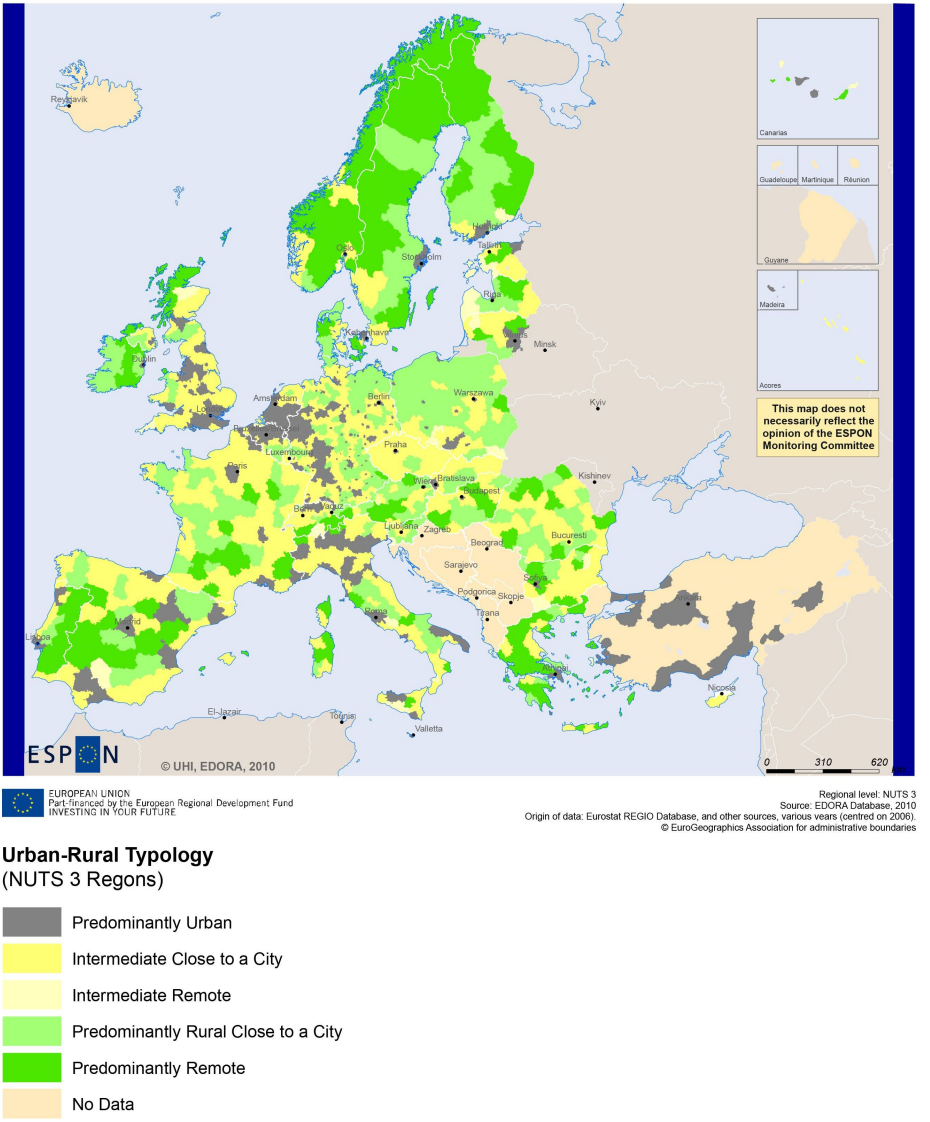

Fig. 1.2. Urban-rural typology (EDORA 2012)

The map shows predominantly rural, intermediate and predominantly urban regions. In the EU27, around 24 % of the population lives in predominantly rural regions, around 35% lives in intermediate regions and slightly more than 40 % lives in predominantly urban regions. In most of the EU12 countries, a larger proportion of the population lives in intermediate and predominantly rural regions, over 40% living in predominantly rural regions and only 20% in predominantly urban ones.

The situation is different in EU15, less than 20% of population lives in predominantly rural regions and over 46 % live in predominantly urban ones.

The proportions, however, differ between countries. In Ireland, Finland, Greece and Denmark, between 43% and 72% of population live in predominantly rural regions (EDORA 2012).

Suburban zone is most seriously exposed to urban sprawl, a phenomenon which is commonly observed across the world, Europe not excluded. It can also be noticed in new EU's member states (acceded to the Union in 2004, and later), until recently socialist countries (Jauhiainen 2006), as well as areas undergoing a demographic downturn (Couch *et al.* 2005). The centralized planning and the non-existence of land markets resulted in more compact cities compared to the western counterpart. In the cities of Central and Eastern countries have been founded some commonalities: general decline in population, privatization of the housing stock, gradual deterioration of housing blocs, progressive deterioration of city centres, increasing the opportunities in the service sector, commercial development, raised the prices in the inner city, increase of pollution (ESPON: Future Orientations for Cities 2013). Therefore, suburbanization is considered to be a natural urban development stage of the post Soviet countries living through active changes.

Negative consequences of the extensive expansion are most likely to appear around major urban centres, because intensity of the suburban development processes and size of the impact zone depends on central city generating expansion and the properties of its geographical situation: economic potential, configuration of the administrative area, development of the communication system and others.

1.1.2. Change in Lithuanian rural-urban interaction

It is particularly relevant to Lithuania in relation to the future of common territorial structure. The vast majority of Lithuanian area is rural and it holds the third of population. The common territorial structure of Lithuania is composed of a system of 3 categories of urban centres (national, regional and local) as well as relevant urban integration axes, intended to ensure the forming and interaction of its parts (Comprehensive Plan of the Territory of the Republic of Lithuania 2002). Rural areas are mentioned there as supporting element of hierarchical urban system. At that, relations of urban and rural territories and improvement of

the quality of life were mentioned then as major items for optimisation of Lithuanian urban system.

The efforts to optimize Lithuanian urban system according Comprehensive Plan of the Territory of the Republic of Lithuania, later, to pursue territorial development according sustainable development principles have been difficult approach from the first steps in EU arena till now. Quondam socialist country on the way to became one of EU member, Lithuania has represented very different territorial development factors urban that shaped and rural areas form the 'old' EU Member States. The destruction of socialism has lead to privatisation process, further increased suburbanisation and sprawl, decline of population and social polarisation. Moreover, previous industrial sites have been abandoned and contaminated.

Some external insights from rural-urban analysis that has been accomplished by Shucksmith (Shucksmith *et al.* 2009) using data from EQLS (European Quality of Life Survey) for 2003 may reveal the distortion of Lithuanian urban system. The results of the analysis had substantiated that the differences between urban and rural areas in Lithuania become greater (similar to the east and south countries of EU) than in the richer EU countries (UK, Germany, Sweden etc.). It has been generally revealed that rural areas are disadvantaged in comparison with the urban, with a markedly lower level of material welfare and quality of life (lower levels of income, lack of basic household items, housing conditions and basic amenities), in level of education, IT literacy and Internet access, unemployment and employment in primary production (Bock *et al.* 2014).

Moreover, Lithuania's emigration rate is among the highest in the European Union. According data from the Statistics Lithuania (Statistics Lithuania 1990–2011), Lithuania lost approximately 730 thousand people in 1990–2011. In addition, rural areas lost 9,5 % of resident population in 2008–2013. The rate of population losses is identical to urban areas. However, the rural population is falling and the average age of those that remain in increasing. About 40 % of rural people are living below the poverty threshold.

Support for the development of rural areas outside agriculture is being provided through EU's regional policy. Thus, expenditure by the European Regional Development Fund in favour of rural areas has been quite substantial during the last programming period (2007–2013) (Copus and De Lima 2014). Funds are mostly spent on providing or improving infrastructure (transport, information and communication technologies and energy), promoting entrepreneurship and innovation, stimulating and aiding the creation and development of enterprises outside agriculture, promoting cooperation between enterprises and (regional) research institutions, and providing and developing (labour) skills needed for the regional economy.

Local development method 'LEADER' allows local actors to develop an area by using its endogenous development potential. The implementation of LEADER local development approach in the last period reached 99 % of Lithuanian countryside. However, they are often separated from other rural and regional development actions, and the money made available for them remains limited. Moreover, the relationship between local actors, with their bottom-up approach, and national or regional actors, with their top-down approach (and their overall responsibility for the programmes), can still sometimes be difficult.

Therefore, Lithuanian Rural development programme for 2014–2020 (Lithuanian Rural Development Programme for 2014–2020) recognizes that despite the implementation of the LEADER method and EU Funds, it is necessary to improve living conditions in rural areas.

The situation is different in the Lithuanian largest cities' districts (Vilnius, Kaunas, Klaipėda). Lithuanian researchers (Aleknavičius *et al.* 2014) have performed the analysis of Lithuanian rural settlements based on archive of National Land Fund (National Land Fund 2015) and data collection of Statistics Lithuania (Statistics Lithuania 2015). Social statistic review has demonstrated a trend of concentration of people in large rural settlements that provides services for rural residents. Number of rural residents in large rural settlements from 2001 to 2011 has increased 9,6 % in Kaunas district, 26,4 % in Klaipėda district and 12,7% in Vilnius district.

Large rural settlements are usually attracting city residents to develop their new (better) residential environment in more affordable settlement, but continue exploiting the infrastructure and services of neighbour cities. One more important change of rural areas occurs here. The activity of such settlements residents differs and is less concerned with agriculture. In general, most rural residents worked in agriculture till 2006, but later traditional activity of rural residents has lost the advanced position and disposed it for service sector.

It seems that suburban rural settlements in close neighbourhood of regional metropolis are criss-crossed by multitude of urban-rural relationship and linkages and could at the best reveal gaps of previous urban-rural interaction and mistakes that we have made in development of living conditions both in rural and urban areas. This could reliable insights for qualitative future of urban-rural territorial development in large cities' districts. Rural settlements of Vilnius (9), Kaunas (12), Klaipėda (5) suburbs that are located in largest cities' districts and have experienced increase of residents (more than 500 people) in past 25 years have been selected as the object for this research. This choice reflects on the most affected areas of urban-rural interactions.

Table 1.1. The analysis of selected rural settlements of Vilnius, Kaunas and Klaipėda suburbs those are located in large cities' districts

	Region, District (Municipality)	No.	Title	Change of residents per 1989–2011
1.	Vilnius district	1	Didžioji Riešė	+ 2059
		2	Valčiūnai	+ 1794
		3	Gineitiškės	+ 984
		4	Avižieniai	+ 960
		5	Riešė	+ 815
		6	Zujūnai	+ 728
		7	Galgiai	+ 615
		8	Bendoriai	+ 552
		9	Antežeriai	+ 533
2.	Kaunas district	1	Raudondvaris	+ 1502
		2	Ramučiai	+ 1482
		3	Ringaudai	+ 1434
		4	Domeikava	+ 1230
		5	Teleičiai	+ 1183
		6	Užliedžiai	+ 797
		7	Neveronys	+ 782
		8	Linksmakalnis	+ 699
		9	Noreikiškės	+ 649
		10	Radikiai	+ 616
		11	Lapės	+ 587
		12	Giraitė	+ 548
3.	Klaipėda district	1	Dercekliai	+ 1773
		2	Žiaukos	+ 699
		3	Kiškėnai	+ 622
		4	Kalotė	+ 621
		5	Kuliai	+ 529

This process is under the surveillance more than 40 years and it is difficultly controlled. Therefore, the development of suburban settlements in largest cities' districts according regional hierarchical network in relation to small demographical resource should be more qualitative, than quantitative or territorial (Comprehensive Plan of the Territory of the Republic of Lithuania 2002).

1.2. Main drivers for urban sprawl (micro level)

In order to systemise the literature on drivers of urban sprawl the following dimensions have been considered: scale, demand and supply and domain (ESPON: Future Orientations for Cities 2013). Scale is dividing in three levels: macro (political and economic paradigms that shape the nature of the urban societies), meso (where much of the discourse about the causes of urban sprawl can be found) and micro level (captures the decisions of individual actors in the urban system).

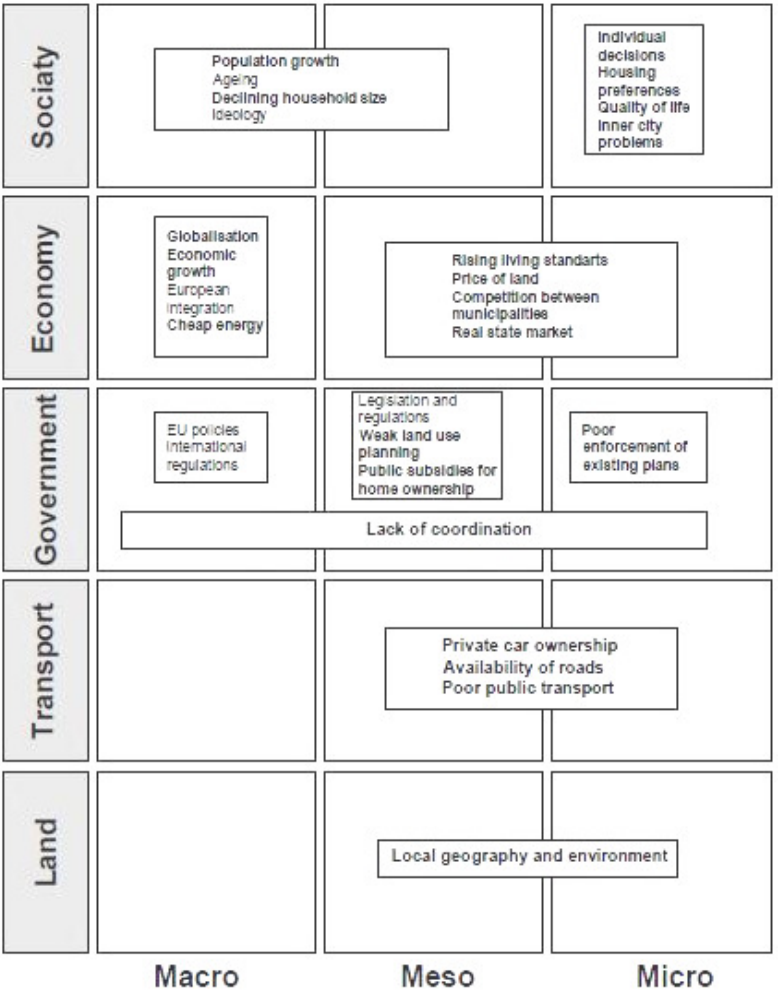

Fig. 1.3. Main drivers of current urban sprawl in Europe (Lennert *et al.* 2010)

The drivers of urban sprawl focus on the demand, but the supply side may be more important than demand alone (Dosch 2008). Domain includes society, economy, governance, transport and land. This categorisation relates to the ESPON projects on polycentricism and economic change (ESPON 2006) and to the basic determinant blocks of regional competitive performance presented in FOCI project (Lennert *et al.* 2010).

Quality of life in Fig. 1 is one of the main factors relevant at micro level. The quality of life in urban planning can be accepted as the final result of a sustainable city and wider spatial development. Cities can influence many factors of quality of life: build and natural environment, mobility within the city, urban aesthetics, accessibility to services, et.

How much this factor actually influences urban sprawl and how more precisely to assess it remains an open question. Some studies of quality of life are conducted at national level, some at regional level, but very few are conducted at a lower scale like neighbourhood or sub-city level (Tesfazghi et al. 2010; Woldetinsaye 2011), rather through the urban-rural interaction.

1.3. The concept of quality of life in urban planning

The quality of life can be investigated considering economic, social, psychological, medical etc. positions. Certainly, every academic subject uses a different approach to examining the construct of the quality of life (Beham *et al.*2006) and applies the concept itself at individual, local community and public levels. Nearly 50 years ago, a conceptual idea of referring to social-economic research, which is a component of many-sided public development and welfare, as to investigation into the quality of life was formed in the U.S.A. Scientific literature interprets the concept of the quality of life with respect to different criteria and combinations of various factors. However, the definitions of the quality of life most frequently embrace individual, public, emotional, social and physical well-being. From an urban point of view, the sustainable development of modern cities seeks for in-depth research on the quality of life, which is an integrated part of investigation into this particular field. The quality of urban life can be accepted as the evaluation of life circumstances individually set by community members, whereas the fundamentals of the quality of life, as a social equivalent of environmental performance, are related to the benefit received from any economic activity. Thus, it can be concluded that residents will prefer a living place in the urban area if cities satisfy their expectations: an outstanding quality of life that is admitted individually, i.e. a sustainable city (Burinskienė 2003).

Striving for the quality of urban life means the ability to open up an opportunity to implement individual natural and legal rights and stay personally satisfied with things available in different areas of life. The society itself or simply individuals construct a distinctive quality of life model that can be acceptable to them only. Such apparently multi-dimensional attitude encourages researchers in finding ways of how to more accurately analyse, measure and evaluate the situation, i.e. to establish objective criteria for a subjective assessment of the quality of life of community members, the criteria should reflect the conception of the quality of life of the whole community. Research on the quality of life is often abstract, and evaluation using traditionally accepted indexes (for example, household assessment, living conditions estimates) more openly displays the condition of living standards in one or another country rather than the situation showing the quality of life itself. The previously shaped opinions suggest that economic growth based on increasing income has been a key tool for improving the quality of life. However, other factors can also have a crucial impact; a physical and natural urban environment as well as population health may influence a number of more vulnerable groups of the inhabitants.

As quality-of-life indexes may vary substantially, different countries present different lists of such indicators. According to data on research conducted by the real estate magazine International Living issued in the U.S.A., in 2010, Lithuania reached the 22nd position considering the quality-of-life index. According to the information provided by the same magazine, Estonia achieved the 32nd and Latvia – 40th positions respectively. 194 countries were involved in the performed investigation. The authors of the research calculated the quality-of-life index referring to nine categories, including the cost of living, leisure and culture, economy, freedom, health state, infrastructure, risk and safety, climate. The annual World Report on social well-being is prepared by the United Nations Development Programme (UNDP) and counts Human Development Index (HDI) in 175 countries. Considering three basic components of human and social development (average life expectancy, adult literacy rate and combined gross enrolment ratio in primary, secondary and tertiary education, gross domestic product (GDP), Lithuania takes the 45th position (Štreimikienė and Mikalauskienė 2009).

A comparison of the results of international evaluation systems providing quality-of-life indexes shows that the position attained by the State differs. This is due to a different application of the indexes that create systems for the quality of life and because of a lack of a common system.

Subjective and objective indices of quality of life

The previous experience points to either only subjective or objective indexes used for evaluating the quality of life. The selection of the indexes used to be determined by a choice made by the researchers or by a possibility of conducting research on the quality of life. An objective evaluation of the quality of life is based on statistical data. The source of data on subjective indexes most frequently involves questionnaires and reports on investigations indicating the consciousness of urban dwellers concerning the quality of life and personal welfare of the population. Subjective measurements of the quality of life are usually expressed applying to the scale showing degrees from 'fully satisfied' to 'very dissatisfied'. A share of GDP attached to a single person was the very first attempt to somehow assess the quality of life. Nevertheless, it has been noticed that this particular index cannot reflect subjective expectations and achievements in sustainable development. Therefore, the level of assessing the quality of life can contradict the reality. Moreover, this index is a commonly accepted macro-economic indicator. Thus, it should be emphasized that with reference to GDP, the development, progress and recession are the areas of general evaluation. To relate the measurement of the quality of life to the evaluation results of sustainable city development, the GDP index is still more complex to be applied for assessing the quality of life in a certain living area. In 1980, a transport studies group from the University of Westminster, United Kingdom, brought together experts and society members to identify the qualities of a civilized city and establish the indexes having an impact on forming the characteristics of economy, environment and the quality of life (Table 1).

The above table shows that the indexes evaluating the quality of life cover not only personal income, employment, physical and psychological health, social needs for education, rest and spare time but also surroundings and the built environment. Eventually it is supposed that the evaluation of objective indexes only cannot convey the real quality of life (Foo 2000). On the other hand, subjective indexes cannot disclose the specificities of a physical environment and displace conditions for the place of residence (Das 2008). Both evaluations, in terms of scientific research, in the context of spatial planning, encourage revealing the relationship between objective and subjective factors (Marans and Stimson 2011; McCrea *et al.* 2011). An overview of scientific research reminds that the quality of life consists of an integrated assessment of subjective and objective indexes. Therefore, a conceptual model for measuring the quality of urban life, suggested by Rogerson (1999), covered the qualities of a physical urban environment, human characteristics (giving more weight) and personal experience (sense of welfare analysis) and was supplemented with establishing personal goals and expectations.

Table 1.2. The qualities of the civilized city identified by the expert group formed by the transport studies group from the University of Westminster and the indexes forming the characteristics of economy, environment and the quality of life (Cowan 2005)

Qualities of the civilized city	Indexes of economy, environment and the quality of life
a) decreasing crimes / increasing safety; b) cleaner and more attractive environment; c) satisfactory employment opportunities; d) health of the population; e) decreasing poverty; f) improving living conditions; g) high quality education system; h) great availability of local services; i) models for more sustainable consumption.	Violent and non-violent crime, safety (traffic, personal), employment (unemployment rate), remuneration (average weekly earnings), education (acquired background), health-state (problems of the incidence of congestive heart failure and severe breathing), weather quality (quality of local weather), noises (disturbances in the street and at home), accommodation conditions (state, homelessness), transport (flows, traffic-jams, travel time variation, economic viability (non-residential construction), sustainability (a rise in , recycling), accessibility (walking comfort and approachability, relative mode for travel time), travelling and activity (travel with no car, time spent out of home), community (sense of belonging, local infrastructure of spare time/rest).

The physical urban environment meets every day needs and complies with the expectations of the population, which causes a high quality of life. Investigation into the quality of life in different localities (cities, regions, states) or communities reveals that the presently applied indexes also indicate a public attitude towards this issue. The indexes distinguishing personal features are used for establishing the distribution of resources so that to improve the quality of life, assess planning impacts and help with achieving the objectives. Thus, in the field of spatial planning, the evaluation of a general quality of urban life discloses two groups of indexes: the first one defines the surroundings and physical environment of the city, whereas the second depicts personal well-being and expectations of the population. Although the great potential for relationship between indexes is noticed, the indicators that can be applied for preparing, implementing, monitoring and revising urban development projects, which should be a useful tool for scientific research, are still a minority (Revi and Duble 1999). The first attempt to design an index system showing the quality of life was made in the U.S.A (Wheeler 2004). Considering experience individually gained by one or another country to evaluate a general condition of the quality of life, a wide complex calculation and comparison of measures –

Human Development Indexes, including Social Development Indicator, the Index of Sustainable Economic, Personal Savings Rate, Ecological Footprint, etc. can be observed. These are relative measures quantitatively defining variations in the quality of life in terms of time and space. The measures are expressed in numbers and periodically refreshed so that to reflect quantitative changes in the researched quality of life among different countries. All indicators making indexes are GDP modifications made introducing modifications in national accounts in order to involve a higher number of determinants such as environmental degradation, natural capital depreciation, etc. (Štreimikienė and Mikalauskienė 2009). Obviously, the index can assist in displaying tendencies towards the quality of life, i.e. indicate whether the quality of urban life is decreasing, increasing or remains stable.

Quality of life in Lithuania was measured empirically by Vanagas (1997, 1999), Grabytė-Bėčienė (2004), Milaševičiūtė, Pukelienė and Vilkas (2006) and others. Vanagas used investigation of correlation between selected cause and effect quality of life variables (1999). Milaševičiūtė employed methodology used on subjective evaluations (2006). Effects of quality of life have been analyzed by Burinskienė, Rudzkienė and Venckauskaitė (2004, 2005, 2007, 2011, 2013). The subject of quality of life was investigated conceptually by Norkus (2004), Merkys (2008), Pukelienė and Starkauskienė (2009).

The tendencies can only be revealed under the circumstances of long-term index measurements: sustained statistics of the index must be provided. The longer the index has been calculated, the more precisely the development of the index and the quality of life reflecting progress can be forecasted. The process of making major strategic decisions important for the city and its agglomeration shows that this tool can be successfully used for setting the level of urban progress, establishing deviations and promoting the efficiency of implemented plans and programs (Cavric *et al.* 2008). On these grounds, promising priorities of spatial planning can be identified, as they allow estimating territorial differences in certain indexes thus offering measures for equalizing them (Burinskienė 2003). Evidently, the index combines subjective and objective indicators for evaluating the quality of life and therefore becomes more precise involving a higher number of subjective indicators. The analysis of quality-of-life indexes applied in Lithuania has revealed that, at the government level, the Department of Statistics to the Republic of Lithuania imparts statistical information on changes in the quality of life and collects and examines data considering 8 topics that define the quality of life at national and regional levels. The document investigates the level of the risk of poverty, severe material deprivation rate, the coefficient of income distribution, the level of housing deprivation, the proportion of persons living in households with very low work intensity, fixed term employment contracts, employed population at-risk-of-poverty, unemployment level, average life span

expectancy, infant mortality rate, overall mortality rate, a share of the youth that left school early, a share of the population that acquired lower, middle or highest (primary, basic and secondary respectively) levels of education and the level of lifelong learning. Apart from collecting statistical data, and having evaluated the situation that changes in GDP are not crucial factors in measuring social welfare, environmental and public sustainability and human prosperity, one more area of the quality of life – overall life satisfaction – has been added to the above mentioned 8 topics. In the meantime, statistical indicators has not been applied to this particular field; however, a questionnaire about overall life satisfaction, the assessment of the meaning of life and psychical health has been included in welfare investigation planned in 2013. Thus, one of the major goals is finding a method for providing a subjective opinion with an objective form thus creating indexes having an impact on a general quality of life through variations in territory planning indicators. In such a case, the quality of life could be reached referring to a single index generalizing other quality-of-life indexes.

1.4. Quality of life issues in urban-rural interaction

Quality of life is a good concept to use if the individual perspectives of the inhabitants are in the focus of the planning activity (Rusanen and Hooli 2011). However, attempts to assess the quality of life show that every person and/or society can devise a unique formula the will have an individual character and cover specific components and criteria for the quality of life.

In order to operationalise the concept and stimulate fruitful research results the focus should be on certain elements of quality of life – such as service provision or accessibility – rather than on the entire concept (Rusanen and Hooli 2011).

Author refers to quality of life making the abstract quality of life concept as concrete as possible – as quality of suburban residential environment in urban-rural interaction.

Eight types of urban-rural interaction that have been identified in ESPON 2013 project EDORA helps here to form quality of life issues in urban-rural interaction:

1) economic linkages;
2) travel to work patterns;
3) service access and provision;
4) business and social networks;
5) amenity, leisure and recreation;
6) governance, partnership and civic society;
7) migration and lifestyles;
8) physical infrastructure and resources.

Courtney et al. (2009) have provided a comprehensive review of the literature relating these urban-rural interaction types and according to this review provides proposal for theme related indicators/drivers.

Table 1.3. Urban-rural interactions

Concept/Issue	Brief Description of 'wish list' Indicator	Potential proxy indicator	Type: P-Pattern; T-Trend; D-Driver; O-Opportunity; C-Constrain
Economic linkages	Strength of local linkages by rural/urban residents	% of households in lower social groups	P/OC
	Strength of local linkages by rural/urban business	% of small/micro firms	P/OC
	U-R/R-U flows of visitor derived income and expenditure	Visitor expenditure per head of resident population	D/OC
Travel to work	Size and pattern of commuting	% of employees travelling more than 30 km to work	P/D
	Access to private transport	% of households with access to a private car	P/D
	Extent of home working	% of employees working at home	P
Service access and provision	Availability of access to public services	No of doctors/schools per inhabitant	
	Availability of access to private services	No of shops/banks per inhabitant	
	Educational attainment levels	% of school leavers achieving Advanced level (or equivalent)	D/OC
Business and social networks	Number of firms in knowledge economy	% of high tech firms	D/P

Continuation of Table 1.3

Concept/Issue	Brief Description of 'wish list' Indicator	Potential proxy indicator	Type: P-Pattern; T-Trend; D-Driver; O-Opportunity; C-Constrain
	Number and density of business clubs and associations bringing rural and urban areas	Number of regional clusters	P/O
	Number of firms with own website	% of firms with own website	P/D
	Degree of trust between rural and urban business people	% business club/organization memberships	D/O
Amenity, leisure and recreation	Numbers of day and overnight R-U/U-R visitors	Number of tourist beds	D/OC
	Access to high quality amenity and designated natural and heritage sites	No designated heritage sites	D
Governance, partnership and civic society	Strength and quality of R-U partnerships between private, public and voluntary sectors	No of cross-sector partnerships	D/OC
	Strength and vibrancy of civic society	Voter turnout/attendance rates at public meetings	
	Strength and vibrancy of R-U strong and weak ties/bringing and bonding social capital	No of clubs/societies bringing rural and urban areas	D/OC
Migration and lifestyles	Movements and re-locations of people between rural and urban areas	Net in migration from R/U areas	
	Spread of entrepreneurship and innovation between rural urban areas	Levels of entrepreneurship	D/OC
	Quality of life in rural and urban areas	Selected QOL indicators	D/OC

End of Table 1.3

Concept/Issue	Brief Description of 'wish list' Indicator	Potential proxy indicator	Type: P-Pattern; T-Trend; D-Driver; O-Opportunity; C-Constrain
Physical infrastructure and resources	Density and quality of physical infrastructure linking rural and urban areas	Density of road and rail networks	P/D
	Density and quality of IT infrastructure linking rural and urban areas	Broadband coverage and take up	P/D

1.4.1. New suburban residential environment

There is no clear definition of the residential environment in scientific literature. The notion of the residential environment complies best with the notion of the built environment which was introduced 40 years ago in the scientific literature of other countries. The origin of the latter is related to anthropogenic and human behaviour studies, which aimed to explain the impact of the environment on the individual and social behaviour of people (Rapoport 1976). Later the notion of the residential environment was defined as the result of the building process (Lawrence and Low 1990), which was then specified as man-made surroundings that provide the setting for human activity, ranging in scale from personal shelter to neighbourhoods to the large-scale civic surroundings (Moffatt and Kohler 2008).

Lithuanian researchers name the urban environment as a constituent of the whole urban system. The environment is divided into the natural and anthropogenic endogenous environment, where a majority of sustainable urban processes take place, and the exogenous environment without which the existence of the city is practically impossible (Juškevičius and Burinskienė 2007). The residential environment is defined as part of the total environmental system, which interacts through the relationship of the society, economic development and human intelligence (Burinskienė 2007). Such explanation of the notion of the environment in the system of urban territories enables to compare the notion of the residential environment with the urban environment. The latter is described by researchers as an integrated, social, cultural space connecting a relatively compact group of residents (Tupėnaitė *et al.* 2010).

Such explanation of the notions of *the residential and urban environment* and their comparison enables to understand that both natural and artificial

endogenous and exogenous types of the urban environment are indispensable elements of the general system of the environment, and their quality impacts on the inhabitants and the city as well as the residential areas within the city‘s zone of influence (suburbs).

1.4.2. Quality of residential environment

Quality of residential environment is resulted of various components of a specific sector. Each component (build environment, infrastructure, nature, and other facilities of social, physical and economic environment) has special characteristic and value of quality. Most of existing concepts in the field of residential environment quality are in relation with quality of life concepts and find their origin in the research of health, safety, well-being, residential satisfaction and urban physical environment (Van Kamp *et al.* 2003). Quality of life is often equated with well-being, and is amenable to both objective and subjective assessment and analysis (Helburn 1982; Beesley, Russwurm 1989; Felce 1997; Prutkin and Feinstein 2002; Gifford 2002; Bonaiuto 2004; Frey and Stutzer 2005). There is no complete agreement on what describes “good” quality of life. A good quality environment gives sense of welfare and satisfaction to inhabitants by physical, social or symbolic characteristics (Marans and Couper 2000; Olsen and Merwin 1977) have observed that „whatever contributes to the quality of life of a population of people is ultimately determined by them, not by elites of any kind, and people‘s nation of life quality is thoroughly infused with normative values concerning what is god and right in life“. Therefore, every study on the quality of life of any people should be based on their conception of the good life. There are two main ways of conceptualizing quality of life – real conditions of life (objective), and experience of life (subjective).

Objective measures include using original existing data and experts’ judgements and can be useful when validating subjective measures (Van Kamp *et al.* 2003). Though, it has been detected considerable disagreement between assessment of experts (for example planners) and individual persons (Lansing and Marans 1969; Steg *et al*. 2007; Fawcett *et al.* 2008).

Specialists, e.g. urban planners, tend to overestimate what is important to the general experts’ public, while underestimating the importance of individual residents’ factors (Perlavičiūtė and Steg 2012). Therefore, objective measurements alone do not provide a comprehensive understanding of how residents experience their environments and should be complemented by subjective measures (Marans 2003). Objective appraisals of quality of life typically focus on levels of provision of basic human needs, such as housing, healthcare, education, community safety, and transportation (Dasgupta and Weale 1992).

Subjective measures are based on residents' perceptions of their own residential environments, e.g. by asking participants to assess the quality of neighbourhood characteristics (Amerigo and Aragones 1997; Van Poll 1997; Bonaiuto *et al.* 2006; Fornara *et al.* 2010). Based on the Van Poll's research, residential environmental quality is a subjective value concept. This value is defined by value of "residential environmental quality" which is contained essential characteristics as individual residents' satisfaction of house, neighbourhoods and neighbours. Accordingly total subjective value of residential environment quality equal sum assessments of characteristics and components of environment (Van Poll 1997). We can understand, that the residential quality perceived by residents, better defines residential well-being than merely objective indicators of neighbourhood conditions.

Environmental quality is assessment of environment in connection with one or more aspects requirements or for any human need or desire (Johnson *et al.* 1997). Quite number researches have been done in field of assessment of environmental quality (Amerigo and Aragones 1997; Adriaanse 2007; Erdogan 2007; Vera-Toscano, Alteca-Amestoy 2008; James 2008). Some of these researches regarded subjective aspects of quality and especially satisfaction of residents and some others studied objective aspects. Also attempts have done to combine objective and subjective aspects of residential environment quality but there was no integrated system to assessment environmental quality in the local areas.

Most of the existing approaches in the field of residential environment quality emphasize on the subjective and objective characteristics. Census data on objective variables are readily available in spatially aggregated form, and can be combined in composite indices using various weighting schemes. Subjective evaluation of quality of life is more difficult and expensive, since it requires a questionnaire survey of individual respondents, regarding their feelings of satisfaction with various aspects ('domains') of their life, and about their life in general (Andrews and Withey 1976; Chamberlain 1985; Diener, Lucas 2000).

1.5. Main participants in creation process of new suburban residential environment

The main reason of Vilnius city's agglomeration pressure on suburban areas is named in The General Plan of Vilnius District. It is the decreasing quality of the residential environment in the city of Vilnius.

Aiming to compete in the region, so far Vilnius has been considered as the most attractive city for young working people. At the beginning of 2013, the largest proportion of working-age population, compared to the total municipal

population, was recorded in Vilnius city municipality (64,5 per cent), the smallest – in Kaunas city municipality (61,1 per cent) (Statistics Lithuania 2012). However, it is obvious that there is a lack of efforts to keep them on the territory of the city and to renovate the existing residential territories. Residential territories are essential in constructing a compact spatial model of the city. Internal population migration related to rapid growth of the housing sector and wide territorial sprawl into the outskirts of the city and accelerating conversion of gardening allotment territories into fragmented residential territories with no social and engineering transportation infrastructure in General Plan of Vilnius city named as internal factors affecting city development. Therefore emerge life quality disparities among zones, residential districts and individual blocks in Vilnius city, conflicting with the principles of sustainable development (Vilnius City Master Plan 2007). Incompactness of urban structures increases the costs of infrastructure; service development and exploitation, which directly increases the costs of living of urban dwellers. The urban system starts malfunctioning and creates a chain of problems, which, in turn, has a negative impact on suburban territories.

The conducted study in Vilnius revealed that in 2005 residents of the city are capable to identify the impact of the factors of the residential environment. Richer, more educated and younger people tend to evaluate the quality of the environment more objectively and to react more sensitively to such negative factors as air pollution, mess, high traffic volumes, etc. This group of urban dwellers tends to make a decision faster to move from the urban environment to a high quality individual and larger (rural) residential space, which is more favourable to them. Therefore, on suburban territories, single-family houses are built depressively. Such fragments have no social infrastructure, are frequently equipped with a local water supply, sewage network and a heating system of a single-family house or their group. There is no public space, except low technical quality streets (Juškevičius *et al*. 2013). According to researchers, the residents of a living house wish their dwelling was cheap, comfortable, conveniently located, with a well-developed infrastructure and low operational costs. They also prefer ecologically clean, noiseless residential environment, with good conditions for resting, shopping, and transportation to work or another place, with pleasant neighbourhood (Kaklauskas and Zavadskas 2009). Still dependent on the city's social, labour and service infrastructure, the residents who have moved from their urban residential environment to the rural one have no possibility to meet their needs mentioned above. The needs which caused problems in the urban residential environment (ecologically not clean and noisy environment) are satisfied in the new residential environment; however, in the long run, other needs, which are not satisfied in the suburban residential

environment, arise, which later create other problems (a lack of social infrastructure, dissatisfaction with the communication infrastructure, etc.).

Urban dwellers that have moved to a more natural (rural) residential space change the established residential environment of that location as they maintain a specific (urban) way of life. Most of local, rural residents belong to a lower social layer; therefore; they are characterized by a better adaptability even though urban infrastructural structures (e.g. bypasses, etc.) cause their negative reaction. A new suburban residential environment is being developed at rural-urban interaction. The author of research has pointed out two generalized groups of the formers of the suburban residential environment:

1) Urban dwellers that have moved from their urban residential environment to the rural one.

2) Local residents of rural areas.

A new suburban residential environment have been created on the base of part of the old needs satisfied in the urban residential environment, but sacrificed for the satisfaction of subjectively more important priority needs. The residential environment is not capable of satisfying the needs comprehensively due to uncoordinated management of urban and rural systems.

1.6. Conclusions of the first chapter and objectives of the thesis

1. Literature analysis has revealed that an increase in the number of city population, along with the tendency to move to the city, is a powerful incentive to perform research on measuring the level of sustainability and the quality of life in cities.
2. There is a need to precisely define the quality of life in the city so that to properly evaluate and control it. Another crucial point is the indexes that should be used and contribute to the development of a sustainable city. The designed strategy or conceptual model for such city could be based on an integrated evaluation of the quality of life and covers the elements of sustainability (spatial, social, economic and environmental), which empowers the city to follow a sustainable way.
3. Scientific literature presents a number of different interpretations dealing with the concepts of the quality of life and the environment and introduces the models – from theoretical to empirical-research patterns – assessing this understanding. However, no model integrating the index system that evaluates the quality of life in the city has been created and universally accepted.

4. The conducted research is burdened with a diverse and heterogeneous definition of the quality of life in urban-rural interaction. A review of the concepts indicates that understanding the quality of the environment, the quality of life, urban vitality and the ideas of sustainability overlap with each other, though all of those relate to investigations into the relationship between the person and the environment.

So that to achieve the aim of the thesis, the following objectives have been defined: 1) define the concept of suburban residential environment including the connective components of rural and urban interaction. While measuring the quality of suburban residential environment, to evaluate the impact of connections; 2) perform the analysis of internal migration of population between rural and urban settlements in the influence area of Lithuanian metropolitan cities; 3) identify the factors both objective and subjective that are affecting the interaction between urban and rural residential areas and to develop the conceptual model of integrated assessment; and (4) to apply a conceptual model to rural residential areas which are located next to major Lithuanian cities. The results of the quality of expansion in residential areas should be presented together with the form of possible future scenarios.

2

Conceptual model of subjectively and objectively integrated assessment of the quality indices of the suburban residential environment

The development of suburban residential areas influences the increasingly growing disparities between residential areas of a local municipal network. Real positive indicator values of settlements are usually used by planners to characterise the residential quality of a suburban settlement and to decide on its future development. These values frequently differ from choices made by urban residents on living under conditions of such interpretive suburban residential quality. It is the essence of spontaneous development in suburbs. This chapter aims to devise an integrated evaluation instrument that combines the objective and subjective evaluation of the quality indices of suburban residential environment.

Based on results of this chapter 2 articles were published (Burinskienė *et al.* 2013, Lazauskaitė *et al.* 2014, 2015).

2.1. Conceptual model and methodology

2.1.1. Conceptual model

The conceptual model demonstrates how subjective and objective assessments could be combined and what results can be expected from this model (Fig. 2.1).

Two aspects are considered in terms of the quality of the suburban residential environment: perceptions of potential residents and urban planners. Usually, urban planners evaluate the residential environment using extensive indicators that are based on existing data. Attempts have been made to combine these aspects.

The condition of the residential environment could be evaluated according to the principle of comparing numerical values of ten physical indices usually used by planners. Therefore, the real dominant degree of each index will be evaluated additionally, based on physical values of indices. It will be objective weights of indices.

The expert method could be used to analyse the selected indicators in the subjective way. The source of subjective evaluation data of the residential environment could be the opinion of potential residents of the suburban residential environment (experts).

The next ranking stage is to determine the significance (weights) of the applied criteria. The determined weights are subjective, objective and generalised. The entropy method evaluates the real structure of an array of data. Generalised weights of objective and subjective evaluation values of residential environment indices obtained by multi-criteria evaluation methods enable us to determine the sequence of integrally-based priority significances of the suburban residential environment indices.

These results of the conceptual model could help to compare suburban settlements by the existing conditions of the residential quality and the quality of the residential environment expected by potential residents. Such comparison of suburban settlements could be a significant tool for the control of suburban development.

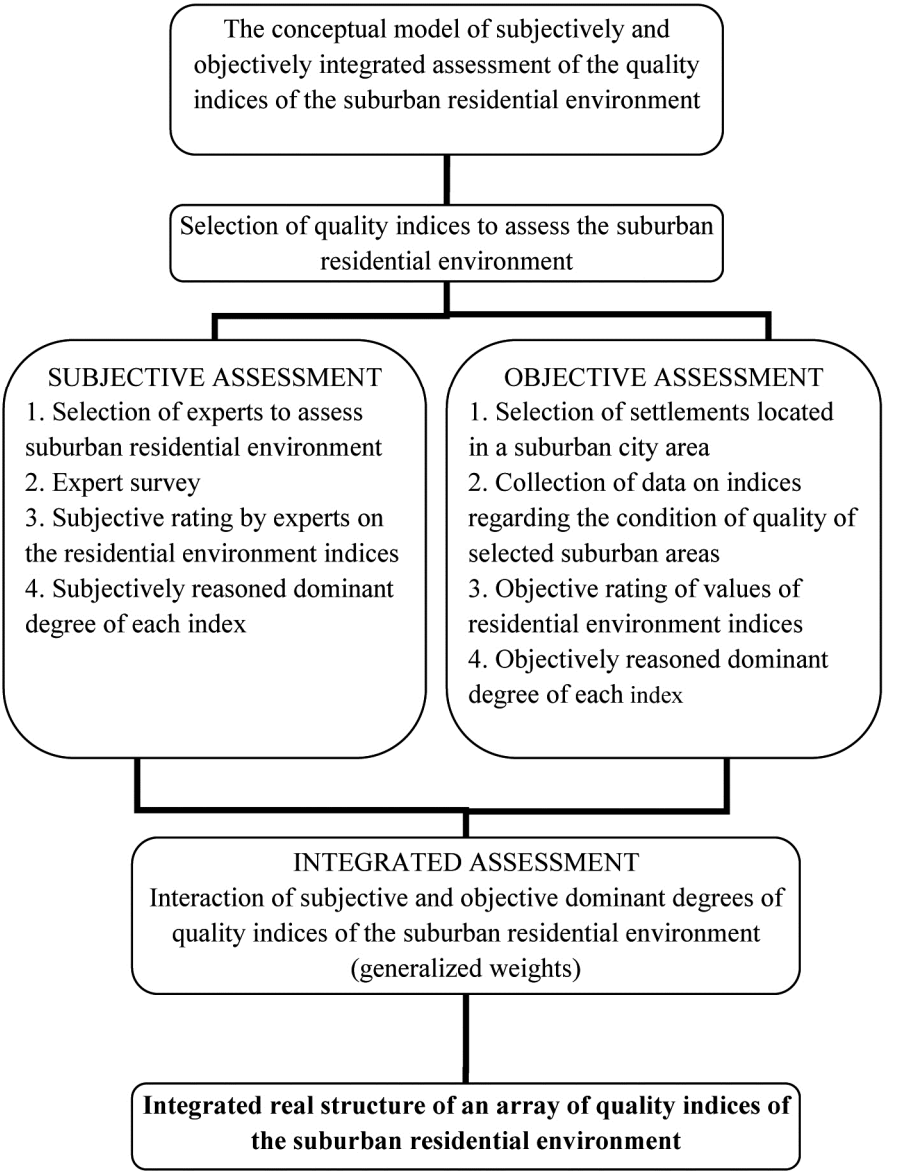

Fig. 2.1. The conceptual model of subjectively and objectively integrated assessment of quality indices of the suburban residential environment (author's)

2.1.2. Methodology

Methods, which mostly support subjective or objective evaluation of quality in the field of urban planning, contain hierarchical multiple regression, multi-attribute utility, expert system (Kauko 2007), conjoint analysis (Van Poll 1997), confirmatory factor analysis (Costello and Osborne 2005; Kline 2005) and multi-criteria evaluation methods. Recently, multi-criteria evaluation methods have been widely employed in both theoretical investigation and solution of practical tasks (Saaty 1980; Hwang and Yoon 1981; Hwang and Lin 1987; Figueira *et al.* 2005; Podvezko and Podvezko 2010; Podvezko 2011; Ginevičius *et al.* 2012; Ginevičius and Podvezko 2013; Yazdani-Chamzini 2014). A multi-criteria evaluation method may be used to assess the structure of criteria values, i.e. the real dominant degree of each index. These will be objective weights of indices determined by the method of entropy, which enables to evaluate the real structure of an array of quality indices of the residential environment.

2.2. Application of the conceptual model in case of the suburban territories of Vilnius

The Vilnius District Municipality stands out in its regional context by disproportionally vast rural residential areas of neighbouring suburbs. Disparities of the population in the residential areas of the district are the consequence of this territorial distribution. The comparison of the data on the population in city and district municipalities of Vilnius in the beginning of 2014 with the data of 2001 reveals a 2,3% decrease in the city and 7,4% increase in the district.

Internal migration of the population is related to the rapid growth of the housing sector and wide territorial sprawl into the suburban territories of the city. Another contributor is the accelerating conversion of gardening allotment territories into fragmented residential territories with no social, engineering or transportation infrastructure. The Vilnius City Master Plan named these internal factors the main causes of the development of the city. They are the reason behind disparities in the quality of life among zones, residential districts and individual blocks of Vilnius city. They are in conflict with the principles of sustainable development (Vilnius City Master Plan 2007). This research identified that the suburban residential environment is mostly influenced by city residents who intend to move there from their urban residential environment in the nearest.

Vilnius suburban residential areas stand out by the increasing average number of inhabitants. The current condition of the residential environment was used for the conceptual application of the model.

2.2.1. Quality indices for the assessment of the suburban residential environment

Author have made an attempt to assess the suburban areas in Vilnius and to identify the indices having an impact on a subjective evaluation of the quality of life on the basis of social research carried out by Lithuanian company RAIT in the city of Vilnius. This research (RAIT 2005) has obtained a representative survey among permanent residents in Vilnius city. Hence, working out the added value of the index summarizing the objective quality of life indicators and a subjective position as well as the formation and application of the index, Vilnius

Municipality has been chosen on the grounds it is the capital and biggest city of Lithuania and the centre of Vilnius district, region and municipality as well as has good spatial and social accessibility to a great abundance of research data taking into account a primary purpose of the population to move to the capital city.

2.2.1.1. Establishing subjective quality of life indexes

For the purpose of realizing subjective quality-of-life indexes in the city of Vilnius, the conducted research used data received via a representative sample taken by UAB RAIT in March 2005. 2575 permanent residents from 16 to 74 years old in Vilnius city were surveyed. Fig. 2.2 shows the index 'The intentions of Vilnius residents to move to another place to live now or in a few years' time' was chosen as a general indicator reflecting the quality of life and expressed in percent.

Investigation into the relationship between the above introduced indexes measured in Vilnius neighbourhoods with other measured variables (17 groups of variables in total) has disclosed that this particular index has a statistically significant correlation with some other indexes from the group 'Environmental assessment of the neighbourhood and residential house'.

To predict a place of residence, a multiple regression model has been used:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \varepsilon \tag{2.1}$$

where $\beta_0, \beta_1, \ldots, \beta_n$ – unknown constants, and ε – random error.

The coefficients of the equation are defined applying the least square method from the equation:

$$\beta = \left(X' X\right)^{-1} X' Y \tag{2.2}$$

For statistical analysis, SPSS software has been used.

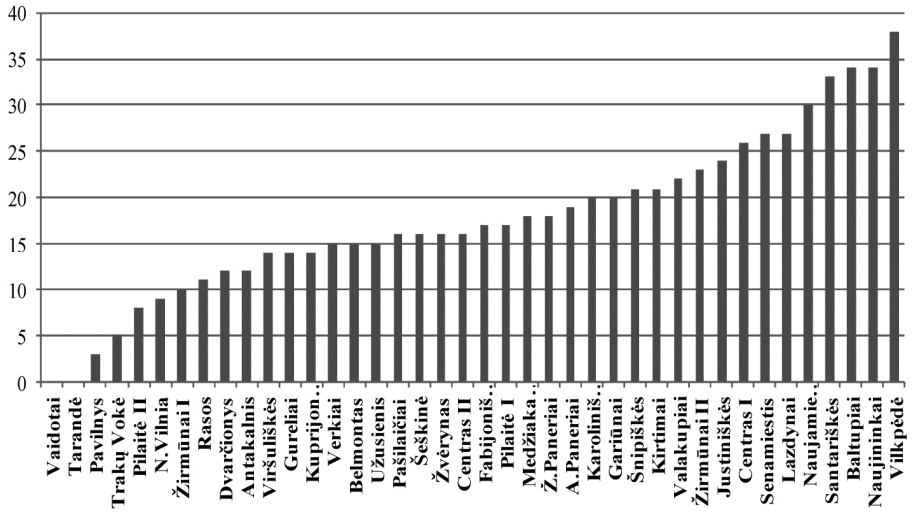

Fig. 2.2. Vilnius residential areas arranged considering recent residents'intentions to move to another place to live, %

To choose statistically significant variables, the 'forward selection' method of correlation analysis and regression analysis has been applied, i.e. the predictive variables are selected employing step by step technique introducing one variable into the equation.

The conducted analysis allowed identifying independent variables (perceivable) most accurately predicting a dependent variable (intention to move to another place to live):

1. Evaluation of the noise generated by transport in the yard – 'felt' (114).
2. Evaluation of air pollution in the residential environment considering neighbourhoods – 'heavy' (162).

Thus, the regression model can be expressed as:

$$y_i = b_0 + b_1 x_{1,i} + b_2 x_{2,i} + e_i,\ i=1,..., 40 \quad (2.3)$$

where Y – intentions to move to another place to live; x_1 – feeling the noise generated by transport in the yard (perceived); x_2 – heavy air pollution in the residential environment (perceived).

Having calculated the coefficients of the equation, a multiple regression equation has been worked out:

$$y = 7.438 + 0.289x_1 + 0.202x_2 + e \quad (2.4)$$

The determination coefficient of the equation – R^2=0.461, R^2_{adj} =0.432.

$$R^2_{adj} = 1 - \frac{n-1}{n-k-1} + (1 - R^2) \tag{2.5}$$

The statistical significance of the coefficients used in the equation has been checked employing criterion *t*:

H_0: β_i=0

H_A: at least one $\beta_i \neq 0$

To verify the hypothesis, an interval of coefficient reliability is made:

$$b_i - t_{\alpha/2,(n-k-1)}\sqrt{S_e^2 C_{ii}} \leq B_i \leq b_i + t_{\alpha/2,(n-k-1)}\sqrt{S_E^2 C_{ii}} \tag{2.6}$$

The hypothesis is rejected if $|t| > t_{\alpha/2,(n-k-1)}$. Done calculations have disclosed the criteria of *t* that are 3.49; 4.908 and 2.650 respectively. The zero hypothesis has been rejected, because the obtained observed levels of significance are higher than 0.05 (0.001; 0.00002; 0.012 respectively).

The multicollinearity of variables has been verified calculating the index of decreased dispersion:

$$VIF(\beta_i) = \frac{1}{1 - R_i^2} \tag{2.7}$$

It is required that most frequently VIF<4. In this case, the condition of VIF = 1 and multicollinearity is satisfied.

As the regression equation coefficients next to variables x_1 and x_2 are positive, it could be maintained that the intention of the residents to move to another place to live is influenced by the noise generated by transport in the yard and heavy air pollution in the residential environment. The higher are the numerical values of these indexes, the more likely residents are intended to move to other places to live.

2.2.1.2. Establishing indices objectively influencing the subjective evaluation of the quality of life

Realizing subjective quality-of-life indexes in the city of Vilnius author has used data received via a representative sample taken in 2005 (RAIT 2005). 2575 permanent residents from 16 to 74-years-old in Vilnius city were surveyed.

The index 'The intentions of Vilnius residents to move to another place to live now or in a few years time' was chosen as a general indicator reflecting the quality of life and expressed in % (Fig. 2.3).

For analysing what measured indexes are related to residents' awareness of the noise generated by transport in the yard, a correlation-regression analysis of selected 13 measured variables z_i, i=1.13 linked to noise has been conducted.

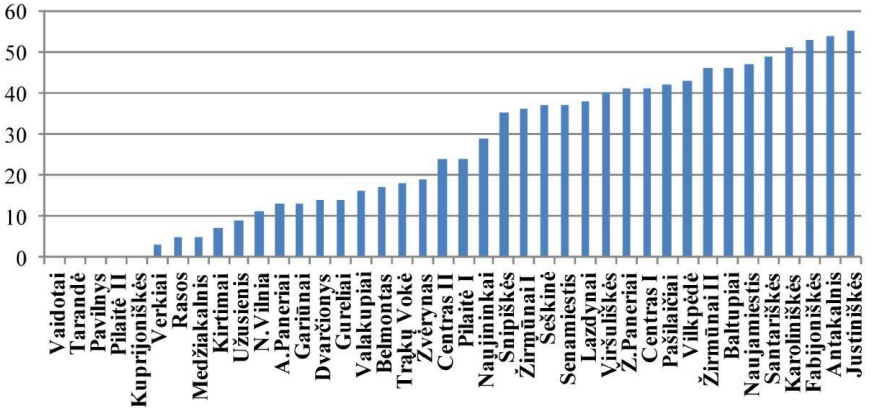

Fig. 2.3. Vilnius residential areas arranged considering recent residents'awareness of the noise generated by transport ('felt'), %

The regression equation has involved two independent variables: population density of the district vt/ha (5th variable) and traffic flow during the peak hour (measured in 2000).

Thus, the regression model is:

$$x_{1,i} = b_0 + b_1 z_{1,i} + b_2 z_{2,1} + e_i \text{ , I = 1,..., 40} \quad (2.8)$$

where: x_1 – feeling the noise generated by transport in the yard; z_1 – population density of the district, vt/ha; z_2 – traffic flow during the peak hour (year 2000).

Having calculated the coefficients of the equation, a multiple regression equation has been worked out:

$$x_1 = 1.31 + 0.295z_1 + 0.007z_2 + e \quad (2.9)$$

The determination coefficient of the equation – R^2=0.629, R^2_{adj} = 0.607.

The coefficients of the equation are statistically significant ($p_{intercept}$=0.075, p_{z1} = 0.00004, p_{z2}=0.005 respectively).

The multicollinearity of variables has been verified calculating the index of decreasing dispersion VIF. The value of both variables VIF=1.284 shows that the condition is satisfied.

Residents' awareness of the noise generated by transport in the yard is influenced by two indexes: population density of the district and traffic flow during the peak hour. The higher are these indexes, the stronger residents are exposed to the noise generated by transport.

The measured variables are related to the perceivable variable 'Air pollution in the residential environment' – 'heavy' (114).

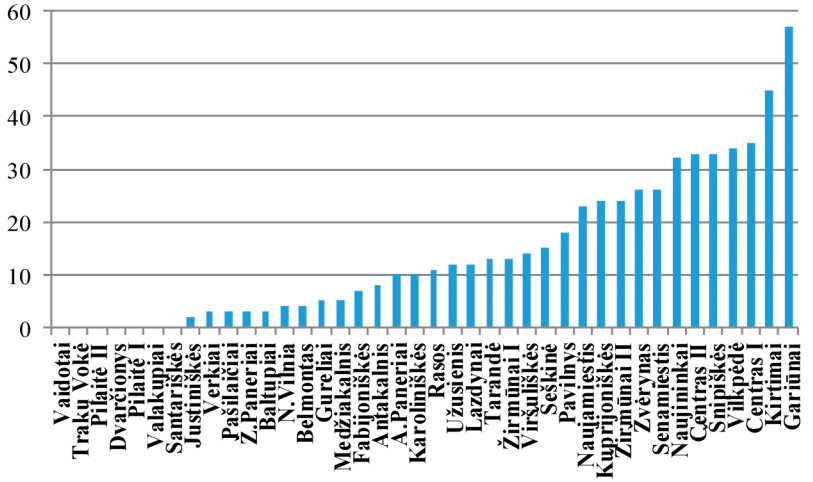

Fig. 2.4. Vilnius residential areas arranged considering recent residents'awareness of air pollution in the residential environment ('Heavy'), %

The conducted analysis has disclosed that, from 16 selected measured variables p_i, i = 1.16 related to air pollution in the residential environment, two independent variables 'distance to the city centre' (73) and 'density of streets' (11) can be included into the regression equation.

Thus, the regression model is:

$$x_{2,i} = b_0 + b_1 v_{1,i} + b_2 v_{2,1} + e_i, \text{ i=1,..., 40} \quad (2.10)$$

where: x_2 – heavy pollution in the residential environment; v_1 – distance to the city centre, km; v_2 – density of streets, km/km^2.

The regression equation is as follows:

$$x_1 = 18.201 - 2.164 v_1 + 1.129 v_2 + e \quad (2.11)$$

The determination coefficient of the equation – R^2=0.642, R^2_{adj}=0.613.

The coefficients of the equation are statistically significant ($p_{intercept}$=0.001, p_{v1}=0.00036, p_{v2}=0.025 respectively).

The multicollinearity of variables has been verified calculating the index of decreasing dispersion VIF. The value of both variables VIF=1.367 shows that the condition is satisfied.

Residents' awareness of heavy pollution in the residential environment is influenced by two indexes: distance to the city centre and density of streets. The longer is the distance to the city centre the lower is the level of air pollution and the higher is the density of streets the stronger the residents feel air pollution.

The accepted indices:

1. Intention to move to another place to live (Y).
2. Feeling the noise generated by transport in the yard X1) – perceived indicator.
3. Heavy pollution in the residential environment (X2) – perceived indicator.
4. Population density of the district, vt/ha (Z1) – measured indicator.
5. Traffic flow during the peak hour, (year 2000). (Z2) – measured indicator.
6. Distance to the city centre, km (V1) – measured indicator.
7. Density of streets, km/km^2 (V2) – measured indicator.

2.2.1.3. Application of Path Analysis to evaluate regression models

The produced regression models can be appropriately combined into a single network revealing causal relationships of the investigated variables. For this purpose, the applied method of path analysis allows simultaneous modelling of the relationship between a few interrelated regressions. Path analysis shows that one and the same variable can act as an independent variable in one type of relationship, and as a dependent – in the other. Moreover, this method graphically displays 'paths' the independent variables on which cause changes in dependent variables. Thus, path analysis facilitates the interpretation of the examined problem, and a graphical form of the path analysis model assists in a clearer understanding of the logic of conventional regression calculations and casual relationship. A general model of causal path analysis, including both regression equations (2.10 and 2.11) is presented in Fig. 2.5.

Every variable has been transformed into a standard form, i.e. if variable *Vi* is measured, it can be transformed into form $V_s = (V_i - \overline{V_i})/\delta_{V_i}$. The same condition applies for residuals e_1, e_2, e_3 accepted as a link to variables the behaviour of which can be explained employing the developed model. Tags near single-headed arrows are standardized regression weights. Tags near rectangles correspond to square multiple correlations.

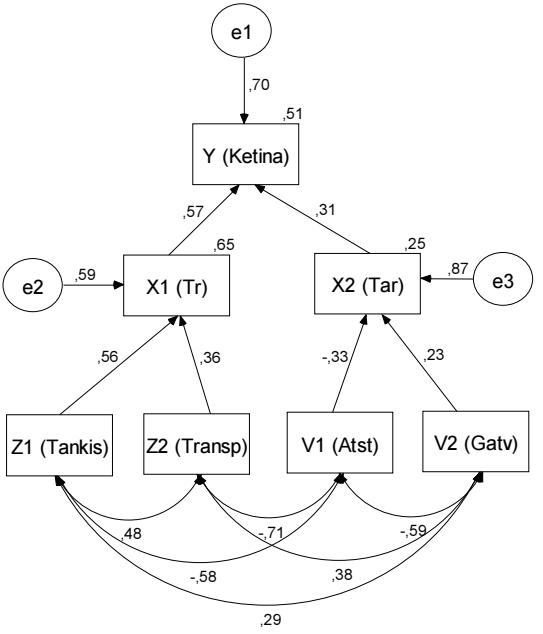

Fig. 2.5. Casual model (path diagram) with path coefficients

To verify model adequacy, model consistency indices, the majority of which are related to χ^2 statistics, are applied. The hypothesis of model adequacy can be expressed as:

1. H_0: the model is adequate for data, i.e. the matrices of variable covariance and model covariance are equal;
2. H_1: the model is not adequate for data, i.e. the matrices are not equal.

The calculation of meaning p that is less than significance level α clearly indicates that the model is adequate for data.

The verification of the adequacy of the proposed model (Fig. 2.5) employing the selected method shows that the received value χ^2 (Chi square) of the model equals 9.5, d.f.=9, o p=0.391. Considering the general indexes of model adequacy, the obtained result is positive; to put it more precisely, the model is adequate when value p is higher than 0.05. Thus, a conclusion that the model is fully adequate for data can be made.

2.2.1.4. Selected indices to assess quality of suburban residential environment

The indices have been selected according to this research and the explanation of the notion of the residential environment and the surveyed physical and functional elements, which may positively and negatively impact both residential environment quality and city residents intention to move to live to another place.

The survey of pertinent scientific literature has shown that the indicators defining residential environment can be numerous and various. It would be difficult to handle such a large body of information; therefore, the authors confined to several dozens of them and selected only those which could meet the set aims best. From the practical point of view, the number of selected indices shall not exceed 10. For the conceptual model authors attempted to select 10 indices. A smaller number of indicators would reduce the accuracy and in formativeness. In order to avoid that, the method of indicators' selection, grouping and expert ranking based on the analysis of scientific literature was applied.

Table 2.1. Selected indices to assess quality of suburban residential environment

No.	Indices	Measure of significance in each settlement
1.	Density of population	Population density, people per ha
2.	Development of a communication system	Streets/roads density, km/ km²
3.	Area of green planting per capita	Green spaces per capita, km²
4.	Commuting time	The accessibility time to the city centre by car, min.
5.	Distance to the city centre	The distance from the settlement centre to the city centre, km
6.	Number of companies providing various services	Number of companies/public bodies providing various services, units
5.	Direct investment per capita	Direct investments from EU funds/local in 2004/2015per capita, EUR
8.	Affordability of housing	Proportion of sales of one room flat prices in recent annual average and average monthly disposable income per household, EUR
9.	Provision of dwelling with engineering networks	Engineering networks such as gas, electricity, water density, km/ km²
10.	Affordability of plots of land	Proportion of sales of land prices in recent annual average and average monthly disposable income per household, EUR

Selected indices cover quality all settings of residential environment, i.e. social, economic, natural and physical (building and infrastructure).

2.2.2. Selection of experts to assess the suburban residential environment indices and the description of the expert survey process

The study conducted in Vilnius in 2005 revealed that the residents of the city are capable of identifying the impact of the factors of the residential environment. Richer, more educated and younger people tend to evaluate the quality of the environment more objectively and to react more sensitively to such negative factors as air pollution, mess, high traffic volumes, etc. This group of city residents tends decide faster to move from the urban environment to a more advantageous, high-quality, more personal and larger (rural) residential space. Such residents were selected as experts for the research.

Experts were selected from among urban residents who intend to relocate to the suburban residential environment in the nearest future. Therefore, experts corresponds the group of residents who are particularly concerned on creation of new suburban residential environment.

Experts had to have serious plans (should be searching for a lot or dwelling in a suburb) to move from the city to a suburban area in nearest future.

Each index of the suburban residential environment had to be evaluated, and the subjective opinion expressed by no less than 7 experts. The aim of the expert assessment was to subjectively identify the most important indices. Kendall concordance theory provides that the number of criteria must be no less than seven (Kendall 1955; Podvezko 2007). According to recommendations of researchers, the number of experts must be less than the number of indices. The degree of expert agreement depends on the number of criteria and does not depend on the number of experts (Kendall 1955; Podvezko 2007). Statistical hypotheses confirm that the concordance criteria χ^2 have m – 1 of free degrees, where m is the number of indices; i.e. depends only on the number of criteria. Furthermore, it has been proved (Libby and Blashfield 1978) that in aggregate modules of estimations by experts with equal weights small expert groups are as good in the accuracy of their decisions and estimations as large expert groups (Kauko 2007).

Next, the research describes the expert survey process. 11 experts were asked to evaluate ten suburban residential indices using the prepared questionnaire and considering the decision to relocate from the urban residential environment to a suburban residential environment. The experts had to decide, which indices were the most significant for choosing the suburban residential environment. Each index was assessed by ranking, on the scale from 1 to 10. Experts arranged the

selected indicators in the order of priority with the greatest weight (1st position) given to the most important indicator, and the lowest weight (10th position) – to the least important one. This assessment by experts displayed the subjective preference of indices. Therefore, it can be used as evidence to suggest the most important quality indicators for urban residents who intend to relocate to the suburban residential environment in the nearest future.

Table 2.2. Subjective rating by experts of the residential environment indices in 2013

No	Quality assessment index of the residential environment	Expert No										
		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
		Rating of indices by experts										
1.	Affordability of land plots	1	7	1	1	4	5	2	9	2	1	2
2.	Affordability of housing	4	4	2	7	5	6	1	10	1	2	3
3.	Availability of dwelling with engineering networks	5	9	7	8	2	3	4	6	4	3	8
4.	Development of a communication system	2	3	6	2	3	1	5	8	5	5	1
5.	Number of companies providing various services	10	8	10	6	10	8	10	3	10	4	6
6.	Density of population	9	10	9	9	9	10	9	1	9	6	9
7.	Commuting time	6	5	3	5	1	4	8	7	8	7	5
8.	Distance to the city centre	7	2	4	10	8	9	3	5	3	10	10
9.	Area of green planting per capita	3	1	5	3	6	7	6	2	6	8	4
10.	Direct investments per capita	8	6	8	4	7	2	7	4	7	9	7

These indicator values show the subjective conception of the quality of the suburban residential environment. They can determine the subjective decision-

making when choosing a suburban settlement, according to its residential quality.

2.2.3. Selection of rural settlements located in suburbs of Vilnius

Four prospective residential areas of Vilnius District Municipality (Avižieniai, Didžioji Riešė, Pagiriai, and Skaidiškės) were selected for the evaluation of the quality of the residential environment in the suburbs. The four residential areas will continue to be exposed to the agglomeration of Vilnius city. These residential areas are expected to experience accelerated expansion and merge with minimal territories for agriculture (Master Plan of Vilnius District 2009).

Table 2.3. Indices of the quality of the residential environment in suburban areas of Vilnius in 2013

		Vilnius district residential areas in the suburbs of Vilnius			
		Avižieniai	Didžioji Riešė	Skaidiškės	Pagiriai
No	Evaluation index of the quality of the residential environment	Numerical values of indices			
1.	Affordability of land plots, LTL/a	11 880	10 090	2 560	3 180
2.	Affordability of housing, LTL/a	1 670	1 670	1 320	1 410
3.	Availability of dwelling with engineering networks, %	47.77	64.97	59.14	55.93
4.	Development of a communication system, km/km^2	1.597	1.369	2.368	1.259
5.	Number of companies providing various services, units	10	12	5	3
6.	Density of population, no of inhabit./ha	7.123	6.832	6.469	7.0471
7.	Commuting time, min	17	19	20	26
8.	Distance to the city centre, km.	12.4	13.6	13.8	18.0
9.	Area of green planting per capita, ha/1 capita	0.018	0.004	0.009	0.001
10.	Direct investments per capita, LTL/1 inhabit.	2 125	2 520	4 133	3451

The condition of the residential environment in the residential areas was evaluated according to the principle of comparing numerical values of ten physical indices. This principle helps to measure the discrepancies in the quality of the residential environment in residential areas that formed in the same zone of impact of Vilnius city. Therefore, it is considered objective.

2.3. Application of multi-criteria evaluation methods for integrated assessment

In the context of territorial planning, objective and subjective evaluation of the residential environment under investigation suggests the interaction of these factors. Methods of multi-criteria evaluation were used for further integral investigation of the residential environment. This investigation is conducted to meet the needs of stakeholders comprehensively and collectively.

2.3.1. Agreement between expert ratings

The rating of indices enables us to verify the agreement among expert opinions. Kendall's coefficient of concordance W determines the agreement level (Kendall 1970; Podvezko 2007).

Suppose that e_{ik} stands for expert rating (data from Table 1), the sum of ranks of each index is $e_i = \sum_{k=1}^{r} e_{ik}$, their mean value $\overline{e} = \frac{\sum_{i=1}^{m} e_i}{m}$ ($i = 1,2,...,m$; $k = 1,2,...,r$; here m – the number of ranking criteria, r – number of experts), then coefficient of concordance W is calculated according to the following formula (Kendall 1970):

$$W = \frac{12S}{r^2 m\left(m^2 - 1\right)} \tag{2.12}$$

The sum of squared deviations S of ranking sums' e_i deviations from the total mean $\overline{e}$ is calculated according to the following formula:

$$S = \sum_{i=1}^{m}\left(e_i - \overline{e}\right)^2 \tag{2.13}$$

The level of expert agreement is not determined by the coefficient of concordance W, but by related value χ^2, which is calculated according to the following formula (Kendall 1970):

$$\chi^2 = Wr(m-1) = \frac{12S}{rm(m+1)} \tag{2.14}$$

It has been proved (Kendall 1970) that when calculating according to the formula (2.14), where χ^2 value is higher than the critical χ^2_{kr} value taken from χ^2 distribution table with the freedom degree $\nu = m-1$ and the selected significance level α is close to null, then the statistical hypothesis about expert agreement of ranks is accepted.

Based on expert ranking (Table 2.3), the calculated coefficient of concordance is $W = 0.302$. The outcome according to the formula (2.14) is $\chi^2 = 29.936$, which exceeds the critical $\chi^2_{kr} = 16.919$ value with a significance level of $\alpha = 0.05$ and the freedom degree $\nu = 10-1 = 9$. It shows the agreement across expert rating.

2.3.2. Determination of index significance

The next ranking stage is to determine the significance (weights) of the applied criteria. The determined weights are subjective, objective and generalised.

The usual practice is to use subjective weights of indices determined by specialists-experts for ranks. Many methods have been developed for the determination of the weights of indices when their significance is ranked by experts (Saaty 1980, 2005; Hwang and Yoon 1981; Ustinovičius *et al.* 2007; Podvezko 2009; Podvezko *et al.* 2010; Gudienė *et al.* 2014; Fouladgar *et al.* 2012; Zavadskas *et al.* 2014; Aghdaie *et al.* 2013; Podvezko and Sivilevičius 2013; Šiožinytė and Antuchevičienė 2013; Wang *et al.* 2013; Tamošaitienė and Gaudutis 2013; Tamošaitienė *et al.* 2013; Zolfani and Šaparauskas 2013). The general idea of ranking is that the most significant criterion is attributed the highest weight, and the calculated weights are usually normalised, i.e.

$$\sum_{i=1}^{m} \omega_1 = 1. \tag{2.15}$$

Subjective weights of criteria may be ranked by applying ranking outcomes. The most significant criterion was ranked by the least number 1 in the ranking table. Therefore, ranks e_{ik} were modified according to the following formula:

$$c_{ik} = m - 1 - e_{ik} \tag{2.16}$$

and the most significant index (rank 1) was assigned the highest value, which was equal to *m*. Modified results are presented in Table 3. The sum of modified ranks was calculated in the same manner:

$$c_i = \sum_{k=1}^{r} c_{ik} \tag{2.17}$$

and subjective weights of indices:

$$\omega_1 = \frac{c_i}{\sum_{i=1}^{m} c_i}. \tag{2.18}$$

The results are presented in Table 3.

Table 2.4. Modified rating table of subjective weights

No	1	2	3	4	5	6	7	8	9	10	11	Rating sums c_i	Weights ω_i	Rating
1	10	4	10	10	7	6	9	2	9	10	9	86	0.1421	1
2	7	7	9	4	6	5	10	1	10	9	8	76	0.1256	3
3	6	2	4	3	9	8	7	5	7	8	3	62	0.1025	5-6
4	9	8	5	9	8	10	6	3	6	6	10	80	0.1322	2
5	1	3	1	5	1	3	1	8	1	7	5	36	0.0595	9
6	2	1	2	2	2	1	2	10	2	5	2	31	0.0512	10
7	5	6	8	6	10	7	3	4	3	4	6	62	0.1025	5-6
8	4	9	7	1	3	2	8	6	8	1	1	50	0.0826	8
9	8	9	6	8	5	4	5	9	5	3	7	70	0.1157	4
10	3	8	3	7	4	9	4	7	4	2	4	52	0.0890	7

At the moment of rating, the structure of criteria values, i.e. the real dominant degree of each index, may be evaluated additionally based on the table of physical values of indices (Table 2.4.). These will be objective weights of indices. The entropy method is known and practically applied for such evaluation. Entropy weights are determined as follows (Hwang and Yoon 1981; Ustinovičius *et al.* 2007):

1. Values of indices are normalised according to the following formula:

$$\widetilde{r}_{ij} = \frac{r_{ij}}{\sum_{j=1}^{n} r_{ij}} \tag{2.19}$$

2. Entropy level of each index is calculated:

$$E_i = (-1/\ln n)\sum_{j=1}^{n} \tilde{r}_{ij} \cdot \ln \tilde{r}_{ij} \qquad (2.20)$$

$$(i = 1,2,...,m);\ \ 0 \le E_i \le 1 .$$

3. The level of change of each index, i.e. non-normalised values of entropy weights, is calculated:

$$d_i = 1 - E_i \qquad (2.21)$$

Entropy weights are normalised values of the calculated d_i :

$$W_i = \frac{d_i}{\sum_{i=1}^{m} d_i} \qquad (2.22)$$

The entropy method evaluates the real structure of an array of data.

Entropy weights, calculated according to formulas (2.19)–(2.22), are presented in Table 2.5. For comparison, the table presents previously calculated subjective weights and generalized weights q_i, which were calculated according to the following formula:

$$q_i = \frac{\omega_i W_i}{\sum_{i=1}^{m} W_i} \qquad (2.23)$$

Table 2.5. Weights of subjective, objective and generalised indices

	1	2	3	4	5	6	7	8	9	10
Subjective ω_i	0.14 21	0.12 56	0.10 25	0.13 22	0.05 95	0.05 12	0.10 25	0.08 26	0.11 57	0.08 90
	1	3	5-6	2	9	10	5-6	8	4	7
Objective W_i	0.35 23	0.01 00	0.01 14	0.06 13	0.23 51	0.00 13	0.02 44	0.01 95	0.22 24	0.06 23
	1	9	8	5	2	10	6	7	3	4
Generalised q_i	0.45 58	0.01 14	0.01 06	0.07 38	0.12 74	0.00 06	0.02 27	0.01 47	0.23 42	0.04 88
	1	8	9	4	3	10	6	7	2	5

The comparative weights of indices enable to present the obtained results graphically (Fig. 2.6.).

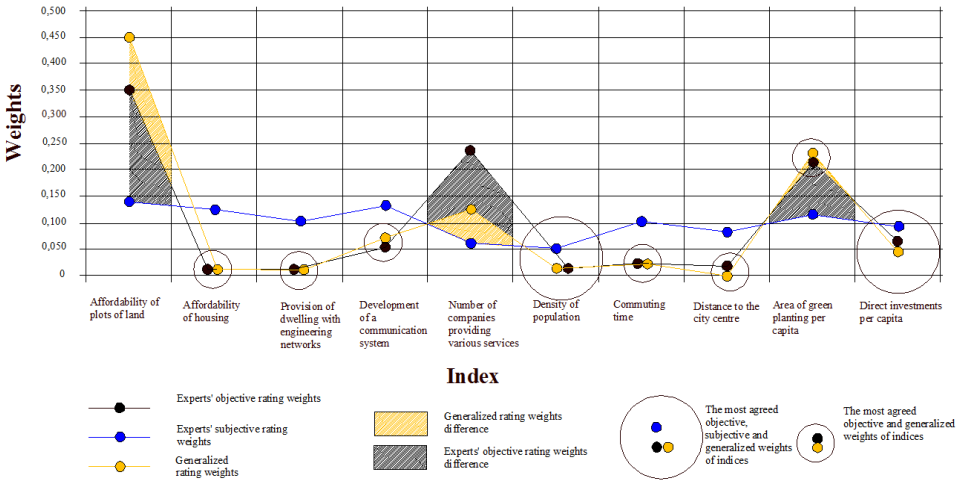

Fig. 2.6. Differences between comparative weights of indices

The presented graph (see Fig. 2.6) highlights the difference between subjective and objective weights (significance) of indices. On average, most of the subjective weights of indices are higher by three-hundredths than the objective weights of indices. Therefore, it could be assumed that only three of them (affordability of land plots; number of companies providing various services and area of green planting per capita) are less significant for experts (potential suburban residents) than when they are evaluated objectively. For example, the objective weight of an area of green planting per capita is by one-tenth higher than its subjective weight. This proportion is relevant when ranking the number of companies providing various services, where the subjective weight of this index is by two tenths lower than its objective weight. The greatest difference of more than two-tenths falls to the comparison of subjective and objective weights of the index of affordability of land plots. When ranking the affordability of land plots objectively, more significance is given to it than when ranking it subjectively.

The comparison of objective weights of indices shows the higher significance of those indices, which dominate in the compared residential areas. The generalisation of the weights of indices shows that objective weights of indices are closer to the generalised ones. A majority of indices of objective and generalised weights (affordability of land plots, availability of dwelling with engineering networks, development of a communication system, population density, commuting time, distance to the city centre, direct investments per capita) differ minimally by an average of three-thousandths. The most agreed objective, subjective and generalised weights of indices are those of the population density and the direct investments per capita.

When applying the generalised weight of an index, three indices – affordability of land plots, the number of companies providing various services and the area of green planting per capita – differed the most by the subjective and objective weights of indices, acquired a well-grounded significance. The weighted significance of these three indices enabled us to devise the following real structure particular to an array of quality indices of the residential environment:

a) affordability of plots of land;
b) area of green planting per capita;
c) number of companies providing various services;
d) development of a communication system;
e) direct investment per capita;
f) commuting time;
g) distance to the city centre;
h) affordability of housing;
i) availability of dwelling with engineering networks;
j) density of population.

2.4. Conclusions of the second chapter

1. The conceptual model of subjectively and objectively integrated assessment of quality indices of the suburban residential environment was established on the basis of scientific insights into the concept of quality of the suburban residential environment and assessment methods.
2. The conceptual model was based on the case of Vilnius. Results demonstrate the difference between used subjective and objective assessment of residential quality indicators.
3. In this research, urban residents who intended to relocate to the suburban residential environment in the nearest future were identified as residents having the most influence on the suburban residential environment.
4. Real positive indicator values of settlements are usually used by planners to characterise the residential quality of a suburban settlement and decide on the future of its development. The difference between the used subjective and objective assessment of residential quality indicators revealed that these values frequently differ from the choice of urban residents to live in such interpretive suburban residential quality.
5. Generalised weights of the objective and subjective evaluation values of the residential environment indices obtained by multi-criteria evaluation methods enable us to determine the sequence of integrally-based priority significance of the residential environment indices.

6. In further research, the integrated sequence could help to compare suburban settlements by the existing conditions of residential quality and the quality of the residential environment expected by potential residents.

3

Future scenarios for suburban development of large cities' districts

This chapter covers a qualitative future development of peripheral rural settlements in districts of the major Lithuanian cities. The previous author' research have shown, that the difference between real positive indices values of settlements which are usually used by planners in Lithuania to characterise the residential quality of suburban settlement and treat future development of this settlement frequently differs from city' residents choice to live in such interpretive suburban residential quality. Development of conceptual model of subjectively and objectively integrated quality indices assessment of the suburban residential environment) have been designed to build a picture of the peripheral future of major Lithuanian cities (Vilnius, Kaunas, Klaipėda) and discuss them in different scenarios, drawing out implications for large cities' districts hierarchical network of rural settlements. The creation of scenarios will be performed under the multiple criteria methods.

Based on results of this chapter 2 articles were published (Lazauskaitė *et al*. 2014, 2015).

3.1. The methodology of development of optimized future scenario

Usually, scenarios are used when problems and relations, private and public opinions significant for solution of problems must be determined (Rudzkienė and Burinskienė 2007). The basis for the suburban rural settlements future development scenario consist multiple analysis described above. The recent scenario use data of Statistics Lithuania, Centre of Registers and National Land Fund (based on the 1989, 2001, 2011 census). Estimating recent structural change in focused locations is demanding of data. Some gaps in the database mean that the identified tendencies must be interpreted cautiously.

3.2. TOPSIS_A a multi-criteria decision analysis method application to develop scenarios

Recently, multi-criteria evaluation methods have been also employed in urban planning. Multiobjective decision support methods with quantitative indicators are the most suitable for sustainable development tasks and possible solutions (Šaparauskas 2004, Zagorskas 2007, Jakimavičius 2008, Tupėnaitė 2010).

There is a wide option of multi-criteria evaluation methods (SAW, TOPSIS, COPRA, etc.).

Suburban residential areas are between complex systems of urban and rural areas. Its residential environment must meet the requirements of potential residents and planners. Suburban residential environment would be difficult to describe with one indicator, which would depend on the quality of its planning. Therefore, the author took the experts' advice, grouped the data and used subjective, objective and integrated assessment of suburban residential areas (see Chapter 1 and 2). The quantitative methods were chosen based on the statistical data and experts' assessments, combining them into a single assessment with standardized indicators. When integrated indicators, their weights and priority sequence were developed, the form of each indicator was identified. The best maximized values of indicators were the biggest and minimized – the lowest.

Author of this research use the developed basis of The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS).

TOPSIS is a multi-criteria decision analysis method, which was originally developed by Hwang and Yoon (Hwang and Yoon 1981). Application of TOPSIS method (Behm, 2005) makes it necessary for the fact that the efficiency function of each solution increases or decreases monotonically. This means that a higher value of any index is always better or worse than a lower value of the same index, depending on whether the efficiency function increases or decreases

(Liaudanskienė et al. 2009). Various theoretical and practical studies are dedicated to the theory and application possibilities of TOPSIS method (Stewart 1986, Kletz 1994; Fang, Vie and Li 2004; Behn 2005; Žukauskienė 2011). The algorithm of the TOPSIS method is shown in Figure 3.1.

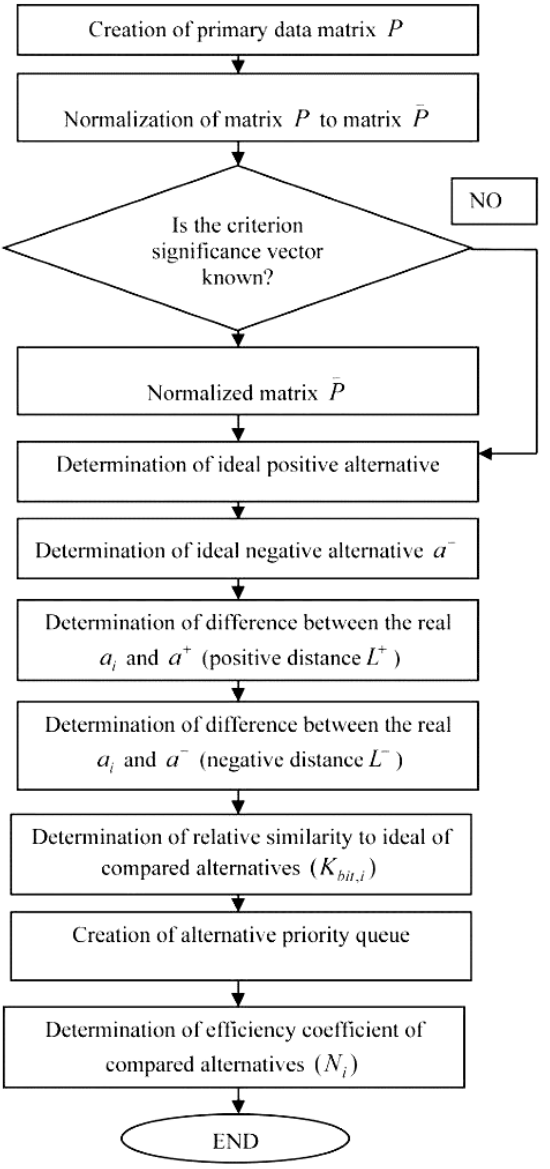

Fig. 3.1. Algorithm of Similarity to Ideal Solution Method (TOPSIS)

The TOPSIS method is based on the formation of a generalized index $K_{bit,i}$ in accordance with the deviation of the compared alternatives from the ideal value, which consists of the optimal indices of the alternatives.

The relative similarity to the ideal point of compared alternatives $K_{bit,i}$ is obtained:

$$K_{bit,i} = \frac{L_i^-}{L_i^+ + L_i^-} \tag{3.1}$$

where $K_{bit,i}$ is the relative similarity of compared alternatives to ideal. $K_{bit,i}$ alternative range is $0 \leq K_{bit,i} \leq 1$ if $K_{bit,i}=1$, than $a_i = a^+$; if $K_{bit,i}=0$, than $a_i = a^-$.

Priority queue is estimated according to $a_i = a^+$ values. At the end efficiency coefficient N_i of the compared alternatives is determined:

$$N_i = \frac{K_{bit,i}}{K_{bit,\max}} \cdot 100\ \% \tag{3.2}$$

First of all the main aim was formed and in this cases it is the formation of a solutions matrix. The matrix is a combination of n alternatives (n – Vilnius, Kaunas and Klaipeda's suburban residential areas) and described m indicators (m – residential suburban environment indications of the quality). In this way basic solutions matrix were created. In order to be able to compare the indicators of different dimensions, the decision matrix was standardized, which in this case mean that indicators with different dimensions were converted into non-dimensional attributes. The vector normalization principle was also applied. Weighted standardized decision matrix was derived by multiplying attributes weight to each rating. After that, ideal solution and negative ideal solution were determined in maximized and mineralized plurality of indicators. Then the distances between each alternative were identified up to positive and negative ideal solution. Finally, the relative distance was determined from each alternative distance to the ideal solution. Based on the obtained relative distances of each option, the list was created for alternatives priorities. The best alternative is the one that has the maximum value of relative distance (Šaparauskas 2004, Jonauskienė and Demčiuk 2009). To be more specific, the alternative that is the closest to the ideal solution and farthest from negative ideal solution.

However, the alternative significances, which were obtained by TOPSIS method and its alternative priority lines, are comparative and allow identifying only the alternative locations what were analysed and were only relative to each other. Nonetheless, while synthesizing a multi-tier alternatives and combining them into a single unified task it is not enough as the accuracy is needed

determining the significance of alternative criteria. There are further developments of this method (Hwang *et al.* 1993; Yoon 1987; Šarka 2000).

Šarka (2000), conducted tallied experimental studies and found out that special calculations is needed before making final decision synthesis, when m_k alternatives are selected in each tier of k. Based on these observations, some inaccuracies in the results may be seen while calculating the value of criteria K_{bit} (for the decisions of each tiers' alternatives/residential areas), then TOPSIS method is used.

It is problematic to plan in which rural residential areas to invest in order to improve their living environment and quality and ensure that expansion will be smooth while the suburbs of the big cities will grow and the potential residents' needs will be met.

Taking into the account that the population next to Vilnius is growing, 9 rural residential areas have been chosen where the number of residents is rapidly growing. After calculations based on 10 indicators these residential areas were identified as alternatives (see chapter 2).

However, while calculating the ideal distance with the method, the results would be completely different, if three or two the best residential areas would be selected from the selection of nine and recalculation would be conducted without chancing any of the primary data (although the priority line would remain the same).

Numerical reciprocal importance of each alternatives are very substantial as based on the values the number of synthesized alternatives is identified which is used for proposed expansion option. Without evaluating it the results are not enough accurate and reliable.

All this encourages relying on TOPSIS_A method (Šarka 2000). The method of proximity to ideal point (TOPSIS) was improved by introducing the absolute mutual significance of single level of alternatives (TOPSIS_A). A new term was introduced: single level, alternative absolute mutual significance. TOPSIS_A method can be used, when the number of the available variants is small and problem solution requires that absolute significance values of the variants should be determined. In making the calculations according to this method, absolute, rather than relative, significance of the variants describing defined variants is determined when intermediate decisions are made at a particular stage.

Method requires step-by-step calculations and selection of the most effective option from a generated set of variants for each settlement.

TOPSIS_A algorithm is explained below. Few decision elements were added to it in order to get absolute ideal point:

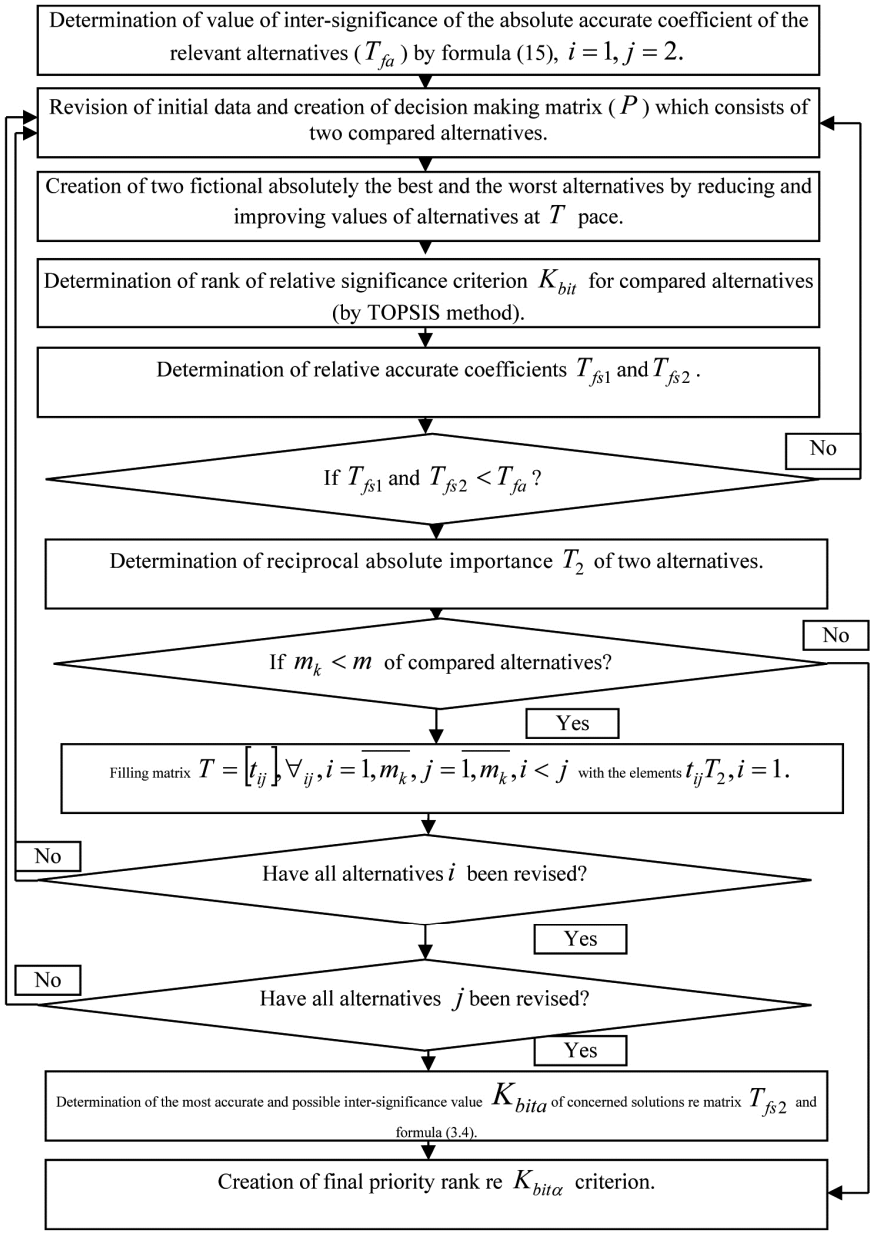

Fig. 3.2. Algorithm of Absolute Similarity to Ideal Solution Method (TOPSIS_A)

The aim of this model is to determine the most accurate and possible inter-significance value K_{bita} of concerned solutions.

The solution is carried out artificially by managing ideal solution and negative ideal solution while adding additional values of alternatives to the solutions. During the solution time all values of absolutely the best alternative are improved at a certain pace T (e.g. 5%), while absolutely the worst alternative are reduced at the same pace T. The coefficient's T_{fs} value is determined in the final stage of decision making:

$$T_{fs} < T_{fa} = \frac{T^2}{m_k \cdot 100} \tag{3.3}$$

here T_{fa} – inter-significance of the absolute accurate coefficient of the relevant alternatives; m_k – the number of alternatives; T – the value of the improvement/reduction pace of the ideal solution/negative ideal solution (%).

Final solution of TOPSIS_A method is reached when the value of this coefficient is equal or less than the absolute accurate coefficient of the relevant alternatives inter-significance T_{fa}, and if only two alternatives are examined in the final stage of the decision making.

Nine suburban residential areas next to Vilnius, 12 to Kaunas and 5 to Klaipėda were analysed in this research.

As Šarka proposed:

1. To get the decision in form of a matrix T:

$$T = \left[t_{i,j}\right] = \begin{array}{c|cccccc} & 1 & 2 & \cdots & i & \cdots & m_k \\ 1 & - & t_{12} & \cdots & t_{1i} & \cdots & t_{1m} \\ 2 & - & - & \cdots & t_{2i} & \cdots & t_{2m} \\ \vdots & - & - & - & \vdots & \cdots & \vdots \\ j & - & - & - & - & \cdots & t_{jm} \\ \vdots & - & - & - & - & - & \vdots \\ m_k & - & - & - & - & - & - \end{array}. \tag{3.4}$$

Which is the matrix for determining the accuracy of the values in terms of alternatives absolute inter-significance.

$T = \left\lfloor t_{i,j} \right\rfloor$, $\forall ij$; $i = \overline{1, m_k}$, $j = \overline{1, m_k}$, . $i < j$. In accordance with diagonal, this matrix has its own values only in the upper part of the matrix. Each element is calculated by the methodology which is part of the standard TOPSIS_A method and determines the reciprocal absolute importance of two alternatives (see image 3.5). In this way values $T_1^{'}$ and $T_2^{'}$ are determined.

The element t_{ij} of calculated matrix indicates the absolute importance of i alternative in relation to j alternative:

$$t_{ij} = \frac{T_2^{'}}{T_1^{'}} \tag{3.5}$$

2. When all alternatives are compared with each other and the structure of T matrix is filled with calculated values of reciprocal absolute importance, final reciprocal significances $T_1, T_2, \ldots T_m$ of each alternatives in relation to each other are determined by the formula:

$$T_i = \frac{\sum_{j=i}^{i} (t_{ji} \cdot T_j)}{i-1}, \forall i; i = \overline{2, m_k} \tag{3.6}$$

Firstly, the value of the first alternative $T_1 = 1$ need to be compared.

3. In this way the solution of this method is completed and obtained values of criteria K_{bita} are presented for the final solution.

All data required for decision making are collected, analysed, combined and entered into the offered database system (DBS) (Šarka 2000). Districts have been assessed separately according their difference of development trends in cities.

3.2.1. A scenario development for Vilnius district

The initial decision-making matrix of Vilnius district has been provided at the tables below (Table 3.1).

Weights of the indices are based on determined significance sequence priority of the residential environment indices (Lazauskaitė 2014). Real initial significance of indices had different measures. Some of them were very high. According to this authors recalculated initial significances to points under its percentage distribution in the settlement. The development of DBS is the first out of three steps implemented in multicriteria method TOPSIS_A. Normalization procedure of the initial data matrix of all districts and decision making. Normalization of indices of the initial data matrix of Vilnius district is presented below, see Table 3.2.

Table 3.1. The initial decision-making matrix of suburban settlements of Vilnius district

					1.	2.	3.	4.	5.	6.	7.	8.	9.
No.	Indicators	Measuring unit.	Directions of optimization	Generalised weight	Avižieniai	Bendoriai	Riešė	Valčiūnai	Galgiai	Didžioji Riešė	Antežeriai	Gineitiškės	Zujūnai
1.	A_l	Points	min	0.4558	2,00	10,00	10,00	10,00	10,00	10,00	1,00	9,00	10,00
2.	G_s	Points	max	0.2342	1,00	7,00	4,00	10,00	1,00	1,00	1,00	1,00	1,00
3.	C_{vs}	Points	max	0.1274	9,00	7,00	8,00	1,00	6,00	7,00	6,00	7,00	6,00
4.	C_s	Points	max	0.0738	8,00	6,00	7,00	5,00	9,00	8,00	10,00	7,00	9,00
5.	I_d	Points	max	0.0488	5,00	1,00	1,00	1,00	2,00	8,00	1,00	0,00	10,00
6.	T_c	Points	min	0.0227	5,00	4,00	3,00	1,00	3,00	5,00	4,00	5,00	5,00
7.	D_c	Points	min	0.0147	4,00	3,00	2,00	1,00	2,00	3,00	5,00	5,00	5,00
8.	A_h	Points	min	0.0114	7,00	7,00	9,00	10,00	9,00	7,00	6,00	7,00	9,00
9.	E_n	Points	max	0.0106	6,00	3,00	3,00	3,00	5,00	4,00	8,00	7,00	4,00
10.	P_d	Points	max	0.0006	4,00	1,00	1,00	1,00	10,00	4,00	2,00	8,00	5,00

Table 3.2. Normalization of indices of the initial data matrix of suburban settlement of Vilnius district

					1.	2.	3.	4.	5.	6.	7.	8.	9.
No.	Indicators	Measuring unit.	Directions of optimization	Generalized weight	Avižieniai	Bendoriai	Riešė	Valčiūnai	Galgiai	Didžioji Riešė	Antežeriai	Gineitiškės	Zujūnai
1.	A_l	Points	min	0.4558	0,0139	0,0694	0,0694	0,0694	0,0694	0,0694	0,0069	0,0625	0,0694
2.	G_s	Points	max	0.2342	0,0125	0,0876	0,0500	0,1251	0,0125	0,0125	0,0125	0,0125	0,0125
3.	C_{vs}	Points	max	0.1274	0,0654	0,0509	0,0581	0,0073	0,0436	0,0509	0,0436	0,0509	0,0436

End of Table 3.2

No.	Indicators	Measuring unit.	Directions of optimization	Generalized weight	1. Avižieniai	2. Bendoriai	3. Riešė	4. Valčiūnai	5. Galgiai	6. Didžioji Riešė	7. Anteženiai	8. Gineitiškės	9. Zujūnai
4.	C_s	Points	max	0.0738	0,0435	0,0326	0,0380	0,0272	0,0489	0,0435	0,0543	0,0380	0,0489
5.	I_d	Points	max	0.0488	0,0389	0,0078	0,0078	0,0078	0,0155	0,0622	0,0078	0,0000	0,0777
6.	T_c	Points	min	0.0227	0,0370	0,0296	0,0222	0,0074	0,0222	0,0370	0,0296	0,0370	0,0370
7.	D_c	Points	min	0.0147	0,0268	0,0201	0,0134	0,0067	0,0134	0,0201	0,0335	0,0335	0,0335
8.	A_h	Points	min	0.0114	0,0159	0,0159	0,0205	0,0227	0,0205	0,0159	0,0136	0,0159	0,0205
9.	E_n	Points	max	0.0106	0,0143	0,0072	0,0072	0,0072	0,0119	0,0095	0,0191	0,0167	0,0095
10.	P_d	Points	max	0.0006	0,0048	0,0012	0,0012	0,0012	0,0121	0,0048	0,0024	0,0096	0,0060

In making the calculations according to this method, absolute, rather than relative, significance of the variants describing defined variants is determined when intermediate decisions are made at a particular stage. Some indices were maximised, other minimised to determine optimized rational variant of all districts (Vilnius, Kaunas, Klaipėda) (Table 3.3).

Table 3.3. Direction of indicators' optimization

No.	Indicators	Direction of optimization	Clarification
1.	A_l – Affordability of plots of land	min	Lower and more accessible prices of land encourage people to buy allotments in suburbs of the cities. In this way not only incoherent urban development is promoted, but also development of rural areas. However, newly created residential environment in suburban rural areas are not a guarantee of consistence and integrity.
2.	G_s – Area of green planting per capita	max	Greenery in the cities are playing an important role in terms of ecological compensation, technical and architectural protective functions, therefore its abundance would improve the quality of residential environment.

End of Table 3.3

No.	Indicators	Direction of optimization	Clarification
3.	C_{vs} – Number of companies providing various services	max	A variety of goods and services ensures better residents satisfaction of social needs. It is always more comfortable to live in places where the higher range of different services exists.
4.	C_s – Development of a communication system	max	The chances that suburban residents would refuse to travel in private cars if public transport, the number of routes and its frequency would be improved/increased in the suburban areas.
5.	I_d – Direct investment per capita	max	Better allocation of public financial resources and the creation of better conditions for possible investments should help to reach sustainable development and expansion of suburban residential areas and to ensure the synergy between urban and rural systems.
6.	T_c – Commuting time	min	Traveling time is calculated as a distance between residential area in suburb and city centre (as employment place of the residents). The choice of residential environment in suburb is considered to be attractive, than the traveling time is short enough between these important points.
7.	D_c – Distance to the city centre	min	The distance from the city centre indicates how well a connection have been formed between the urban and rural systems. The city centre is seen as a major centre of attraction for the territories which are within urban influence zones. The closer residential area is to the centre of attraction the more compact is the city and later its expanding suburbs.
8.	A_h – Affordability of housing	min	Lower and more accessible prices of housing encourage people to buy allotments in suburbs of the cities. In this way not only incoherent urban development is promoted, but also development of rural areas. However, newly created residential environment in suburban rural areas are not a guarantee of consistence and integrity.
9.	E_n – Provision of dwelling with engineering networks	max	This indicator shows the level of the service of engineering networks in residential areas. The higher is intensity – the greater is the chance to create a better living environment.
10.	P_d – Density of population	max	This indicator is described as a residential areas' core in terms of consistency. It shows the attractiveness of residential areas and the rational use of its territory. If residential environment would meet its people's needs in its maximum, then living conditions would be considered favorable, current population would not migrate to other places while the area would be attractive for the new possible residents.

Determination of the rational places of Vilnius district is presented below, see Table 3.4.

Table 3.4. Determination of the rational places variants of Vilnius District, using TOPSIS_A method

Variant priority	Variant №	K_{Bit} value	Variant
1.	7.	1,00	Antežeriai
2.	4.	0,57	Valčiūnai
3.	2.	0,51	Bendoriai
4.	1.	0,49	Avižieniai
5.	3.	0,46	Riešė
6.	8.	0,34	Gineitiškės
7.	6.	0,32	Didžioji Riešė
8.	5.	0,30	Galgiai
9.	9.	0,29	Zujūnai

3.2.2. A scenario development for Kaunas district

The initial decision-making matrix of Kaunas district has been provided at the tables below (Table 3.5).

Table 3.5. The initial decision-making matrix of suburban settlements of Kaunas district

					1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
No.	Indicators	Measuring unit	Directions of optimization	Generalized weight	Domeikava	Radikiai	Linksmakalnis	Teleičiai	Ramučiai	Lapės	Neveronys	Raudondvaris	Noreikiškės	Ringaudai	Giraitė	Užliedžiai
1.	A_l	Points	min	0.4558	8,00	10,00	10,00	3,00	6,00	10,00	10,00	10,00	1,00	7,00	6,00	8,00
2.	G_s	Points	max	0.2342	1,00	8,00	8,00	1,00	1,00	3,00	2,00	1,00	10,00	5,00	1,00	3,00
3.	C_{vs}	Points	max	0.1274	5,00	9,00	6,00	7,00	7,00	7,00	6,00	1,00	9,00	3,00	10,00	5,00
4.	C_s	Points	max	0.0738	8,00	5,00	2,00	8,00	6,00	6,00	5,00	10,00	6,00	6,00	9,00	4,00

End of Table 3.5

No.	Indicators	Measuring unit.	Directions of optimization	Generalized weight	1. Domeikava	2. Radikiai	3. Linksmakalnis	4. Teleičiai	5. Ramučiai	6. Lapės	7. Neveronys	8. Raudondvaris	9. Noreikiškės	10. Ringaudai	11. Giraitė	12. Užliedžiai
5.	I_d	Points	max	0.0488	2,00	0,00	0,00	0,00	6,00	1,00	1,00	9,00	3,00	10,00	0,00	1,00
6.	T_c	Points	min	0.0227	5,00	6,00	1,00	6,00	5,00	4,00	4,00	4,00	7,00	6,00	6,00	5,00
7.	D_c	Points	min	0.0147	7,00	7,00	1,00	8,00	7,00	6,00	5,00	7,00	8,00	8,00	8,00	7,00
8.	A_h	Points	min	0.0114	3,00	6,00	7,00	3,00	3,00	10,00	4,00	3,00	3,00	4,00	3,00	3,00
9.	E_n	Points	max	0.0106	5,00	3,00	1,00	7,00	9,00	6,00	5,00	8,00	3,00	5,00	6,00	3,00
10.	P_d	Points	max	0.0006	6,00	1,00	2,00	8,00	3,00	5,00	3,00	10,00	1,00	3,00	2,00	1,00

Weights of the indices are based on determined significance sequence priority of the residential environment indices (Lazauskaitė 2014). Real initial significance of indices had different measures. Some of them were very high. According to this authors recalculated initial significances to points under its percentage distribution in the settlement. The development of DBS is the first out of three steps implemented in multicriteria method TOPSIS_A.

Normalization procedure of the initial data matrix of all districts and decision making. Normalization of indices of the initial data matrix of Kaunas district is presented below, see Table 3.6.

In making the calculations according to this method, absolute, rather than relative, significance of the variants describing defined variants is determined when intermediate decisions are made at a particular stage. Some indices were maximised, other minimised to determine optimized rational variant of all districts (Table 3.3). Determination of the rational places of Kaunas district is presented below, see Table 3.7.

Table 3.6. Normalization of indices of the initial data matrix of suburban settlement of Kaunas district

					1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
No.	Indicators	Measuring unit.	Directions of optimization	Generalized weight	Domeikava	Radikiai	Linksmakalnis	Teleičiai	Ramučiai	Lapės	Neveronys	Raudondvaris	Noreikiškės	Ringaudai	Giraitė	Užliedžiai
1.	A_l	Points	min	0.4558	0,0528	0,0660	0,0660	0,0198	0,0396	0,0660	0,0660	0,0660	0,0066	0,0462	0,0396	0,0528
2.	G_s	Points	max	0.2342	0,0098	0,0782	0,0782	0,0098	0,0098	0,0293	0,0196	0,0098	0,0978	0,0489	0,0098	0,0293
3.	C_{vs}	Points	max	0.1274	0,0313	0,0563	0,0375	0,0438	0,0438	0,0438	0,0375	0,0063	0,0563	0,0188	0,0626	0,0313
4.	C_s	Points	max	0.0738	0,0445	0,0278	0,0111	0,0445	0,0334	0,0334	0,0278	0,0557	0,0334	0,0334	0,0501	0,0223
5.	I_d	Points	max	0.0488	0,0143	0,0000	0,0000	0,0000	0,0429	0,0071	0,0071	0,0643	0,0214	0,0715	0,0000	0,0071
6.	T_c	Points	min	0.0227	0,0255	0,0306	0,0051	0,0306	0,0255	0,0204	0,0204	0,0204	0,0357	0,0306	0,0306	0,0255
7.	D_c	Points	min	0.0147	0,0214	0,0214	0,0031	0,0245	0,0214	0,0184	0,0153	0,0214	0,0245	0,0245	0,0245	0,0214
8.	A_h	Points	min	0.0114	0,0098	0,0195	0,0228	0,0098	0,0098	0,0326	0,0130	0,0098	0,0098	0,0130	0,0098	0,0098
9.	E_n	Points	max	0.0106	0,0095	0,0057	0,0019	0,0133	0,0171	0,0114	0,0095	0,0152	0,0057	0,0095	0,0114	0,0057
10.	P_d	Points	max	0.0006	0,0067	0,0011	0,0022	0,0090	0,0034	0,0056	0,0034	0,0112	0,0011	0,0034	0,0022	0,0011

Table 3.7. Determination of the rational variants of Kaunas district, TOPSIS_A method

Variant priority	Variant №	K_{Bit} value	Variant
1	18	1,00	Noreikiškės
2	11	0,29	Radikiai
3	12	0,14	Linksmakalnis
4	20	0,13	Giraitė
5	21	0,10	Užliedžiai
6	10	0,10	Domeikava
7	15	0,08	Lapės
8	14	0,05	Ramučiai
9	16	0,04	Neveronys
10	17	0,03	Raudondvaris
11	19	0,00	Ringaudai
12	13	0,00	Teleičiai

3.2.3. A scenario development for Klaipėda district

The initial decision-making matrix of Klaipėda district has been provided at the tables below (Table 3.8).

Table 3.8. The initial decision-making matrix of suburban settlements of Klaipėda district

No.	Indicators	Measuring unit.	Directions of optimization	Generalised weight	1.	2.	3.	4.	5.
					Kiškėnai	Kuliai	Kalotė	Dercekliai	Žiaukos
1.	A_l	Points	min	0.4558	10,00	1,00	1,00	9,00	9,00
2.	G_s	Points	max	0.2342	10,00	1,00	1,00	1,00	2,00
3.	C_{vs}	Points	max	0.1274	9,00	7,00	9,00	1,00	8,00
4.	C_s	Points	max	0.0738	2,00	6,00	7,00	10,00	6,00
5.	I_d	Points	max	0.0488	10,00	1,00	6,00	1,00	1,00
6.	T_c	Points	min	0.0227	6,00	1,00	4,00	2,00	2,00
7.	D_c	Points	min	0.0147	7,00	3,00	5,00	1,00	3,00
8.	A_h	Points	min	0.0114	4,00	5,00	3,00	4,00	10,00
9.	E_n	Points	max	0.0106	4,00	4,00	8,00	6,00	5,00
10.	P_d	Points	max	0.0006	1,00	5,00	10,00	9,00	4,00

Weights of the indices are based on determined significance sequence priority of the residential environment indices (Lazauskaitė 2014). Real initial significance of indices had different measures. Some of them were very high. According to this authors recalculated initial significances to points under its percentage distribution in the settlement. The development of DBS is the first out of three steps implemented in multicriteria method TOPSIS_A.

Normalization procedure of the initial data matrix of all districts and decision making. Normalization of indices of the initial data matrix of Klaipėda district is presented below, see Table 3.9.

Table 3.9. Normalization of indices of the initial data matrix of suburban settlement of Klaipėda district

No.	Indicators	Measuring unit.	Directions of optimization	Generalized weight	1. Kiškėnai	2. Kuliai	3. Kalotė	4. Dercekliai	5. Žiaukos
1.	A_l	Points	min	0.4558	0,1119	0,0112	0,0112	0,1007	0,1007
2.	G_s	Points	max	0.2342	0,1582	0,0158	0,0158	0,0158	0,0316
3.	C_{vs}	Points	max	0.1274	0,0788	0,0613	0,0788	0,0088	0,0701
4.	C_s	Points	max	0.0738	0,0170	0,0509	0,0594	0,0849	0,0509
5.	I_d	Points	max	0.0488	0,0925	0,0093	0,0555	0,0093	0,0093
6.	T_c	Points	min	0.0227	0,0698	0,0116	0,0466	0,0233	0,0233
7.	D_c	Points	min	0.0147	0,0528	0,0226	0,0377	0,0075	0,0226
8.	A_h	Points	min	0.0114	0,0169	0,0212	0,0127	0,0169	0,0423
9.	E_n	Points	max	0.0106	0,0116	0,0116	0,0232	0,0174	0,0145
10.	P_d	Points	max	0.0006	0,0012	0,0061	0,0122	0,0110	0,0049

In making the calculations according to this method, absolute, rather than relative, significance of the variants describing defined variants is determined when intermediate decisions are made at a particular stage. Some indices were maximised, other minimised to determine optimized rational variant of all districts (Table 3.3). Determination of the rational places of Klaipėda district is presented below, see Table 3.10.

Table 3.10. Determination of the rational places variants of Klaipėda District, using TOPSIS_A method.

Variant priority	Variant №	K_{Bit} value	Variant
1	3	1,00	Kalotė
2	2	0,96	Kuliai
3	1	0,60	Kiškėnai
4	5	0,49	Žiaukos
5	4	0,35	Dercekliai

3.3. Scenarios comparison with the demographic tendencies

After the calculations performed by the multi-criteria decision analysis system applying TOPSIS_A method for all suburban settlements of Vilnius, Kaunas and Klaipėda districts, the result have been compared with the demographic tendencies there. The results have been represented in form of two development scenarios for suburban rural settlements of Vilnius, Kaunas and Klaipėda districts. The first one is optimized rational development scenario based on TOPSIS_A application results and the other development scenario is based on trends of rising population. Scenarios are represented in Fig. 3.3., 3.4., 3.5. Visualisations of scenarios have been created with geographic information system (Esri's ArcGIS).

Scenario for Vilnius district

The priority development objective of Vilnius City Master plan (valid until 2025) is to enable the constant increase of the quality of life and to reduce territorial differences. The aim is achieved with tools for sustainable development: together with neighbouring municipalities forming a cohesive city and its adjoining areas system (urban and rural). The development plan of priority directions is provided in Vilnius Master Plan until 2015, which is guided by Plan of Vilnius continuity approach: sustainable urban expansion is aimed, while improving the structure of the city centre and developing the key localized centres. Therefore, Vilnius municipality promotes urban territorial development by focusing on four main areas: the central part of the city, directions of Pilaitė, Ukmergė and Nemėžis.

Inner city development has a priority over suburban areas of urbanization as the city has some rarely built districts. The requirement to use areas in cost-effective way is perceived as more effective way of usage of less overcrowded territories and allowed intensification of integrated urban neighbourhoods. All this ensures that the quality of life in existing residential areas of the city is not deteriorated and is normative.

Vilnius district's master plan is aiming for rational and sustainable network of residential suburban areas and synergy with Vilnius city centre. Due to that, Vilnius district municipalities in their own territory have formed and established hierarchical polycentric network of residential areas, ensuring the best social, economic and ecological development conditions and residents' assumptions of the better quality of life.

Approved Vilnius district master plan is in line with the Vilnius District territory general plan (Vilnius County Territory Plan, Vilnius 2008) and with

Vilnius District parishes' main plans. It is mainly about the largest villages. It stated there that A category centres will be strengthen and identified and noted villages will remain the main multifunctional assemblies of district municipal urban framework. The plan is also about the network of rural areas which are within Vilnius municipality district, have potential and have social infrastructure. There rural areas are already experiencing the agglomeration effects of a prospective period of Vilnius and will experience it in the future, which will result in faster expansion, currently expanding villages will merge with each other and agglomeration areas will formed where agrarian lands will be found rarer. Additional services are prospective in these zones.

26 local or municipal major centres were assigned to V level. These centres are mainly bigger villages with already existing and expanding infrastructure, which supplement the infrastructure of the main parish centres. These expanding centres were identified: they are the municipal b category centres, which are supported and will strongly feel Vilnius agglomeration effect in a prospective period of time and therefore will accelerate the expansion and will merge with residential rural and urban peripheral areas which are nearby, with main its parish centres and in this way agglomerated areas will be formed. It is estimated to save spatial structure of these old rural residential areas as much as it is possible in the structural zones. VI level consists of the remaining network of 1,148 rural residential areas which are related with the above mentioned centres.

Thus, according to the master plan of Vilnius district, the priority for the potential development of rural residential areas in Vilnius district would be: Didžioji Riešė, Zujūnai, Galgiai, Bendoriai, Riešė and Valčiūnai. This scenario reflects the choices of territory planners, specialists and other concerned parties.

According to population growth trends (taking the changes from 1989 to 211) the priority for potential expansion of suburban rural villages in the suburbs of Vilnius would be: Didžioji Riešė, Valčiūnai, Gineitiškės, Avižieniai, Riešė, Zujūnai, Galgiai, Bendoriai and Anteženiai (see the Fig. 3.3). This scenario reflects the subjective choices of residence of the population.

While if taking the author's developed integrated suburban residential environment quality assessment, these suburban areas of Vilnius currently have the highest potential for qualitatively expansion: Anteženiai, Valčiūnai, Bendoriai, Avižieniai, Riešė, Gineitiškės, Didžioji Riešė, Galgiai and Zujūnai (see the Fig. 3.3).

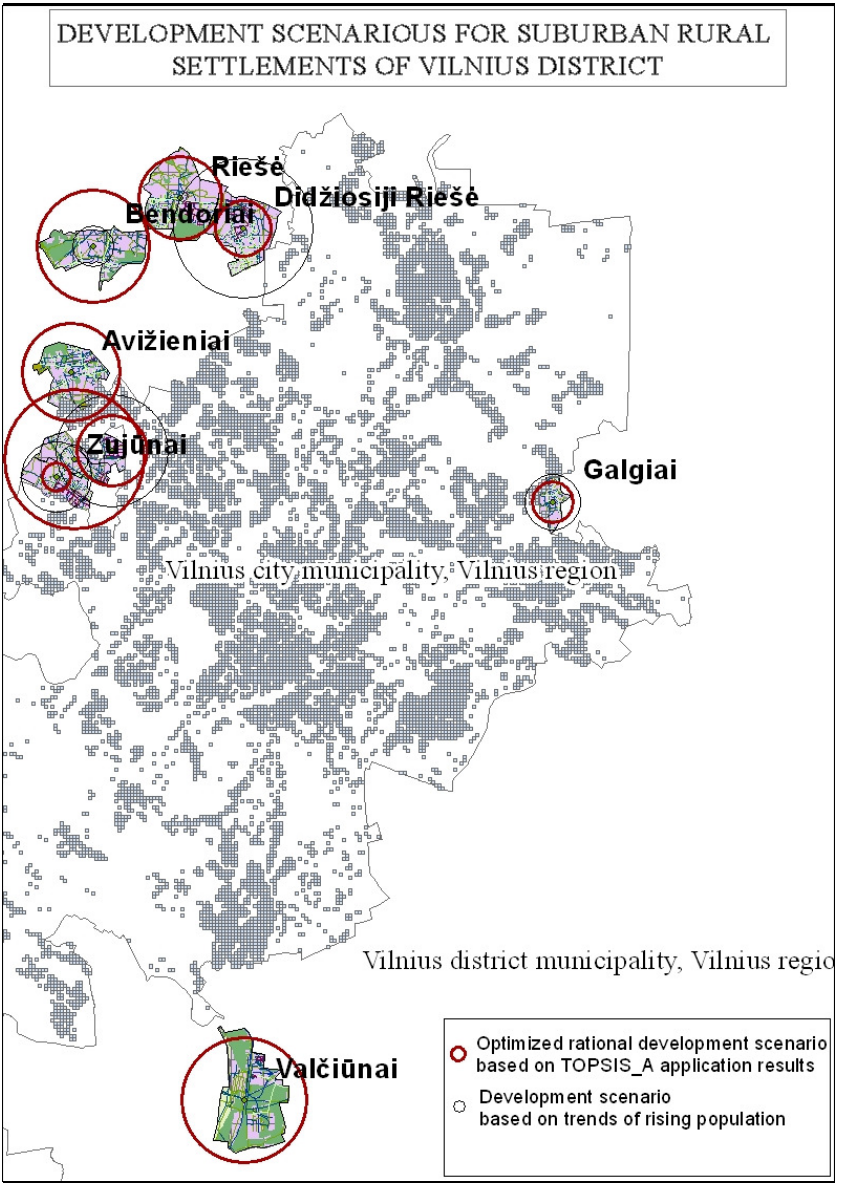

Fig. 3.3. Development scenarios for suburban rural settlements of Vilnius district

3.3.2. Scenario for Kaunas district

The urban situation of Kaunas district is special. It is metropolitan impact of Kaunas habitat. The urban framework of Kaunas district expansion is influenced by the main regional metropolitan centre of Kaunas city and by developed small towns and villages in the network of old commercial tracts.

Increasing traffics in Kaunas, Garliava and avenue of approach of other cities illustrate the growing suburbanization process where due to rising housing and land prices and due to the quality of life in the city the residents are moving to the suburbs.

Currently the network of residential areas in this district is dense enough to ensure the quality of living conditions. Therefore, the current use of the territory optimization is promoted the same as urban areas' agglomeration of Kaunas District master plan.

The master plan has clear priorities of stainable area development and identifies the current non-priority expansion habitats. The main focus must be on the small town which has higher priority – their master plans creation, social and engineering infrastructure development.

According to the Master plan of the Republic of Lithuania a large part of the territory of Kaunas is the habitat effects of Kaunas' city agglomeration and concentration. According to the approved concept, five priority regional development zones are foreseen in this range. The priorities for distinguished residential areas are identified in the approved concept.

Five residential areas have the highest priority (Domeikava, Garliava, Karmėlava, Raudondvaris and Vilkija), eight high priority (Ežerėlis, Babtai, Neveronys, Piliuona, Ramučiai, Ringaudai, Šlienava and Zapyškis) and nine have the priority of development (Giraitė, Ilgakiemis, Juragiai, Linksmakalnis, Mastaičiai, Naujieji Bernatoniai, Sitkūnai, Užliedžiai and Voškoniai) and modernized residential areas (Akademija, Čekiškės miestelis, Kulautuvos, Naujasodis, Piliuona, Samylai, Alšėnai, Kačerginė, Mauručiai, Panevėžiukas, Rokai and Vandžiogala).

Thus, according to the master plan of Kaunas district, the priority for the potential development of rural residential areas in Kaunas district would be: Domeikava, Raudondvaris, Neveronys, Ramučiai, Ringaudai, Giraitė, Linksmakalnis and Užliedžiai. This scenario reflects the choices of territory planners, specialists and other concerned parties.

According to population growth trends (taking the changes from 1989 to 211) the priority for potential expansion of suburban rural villages in the suburbs of Kaunas would be: Raudondvaris, Ramučiai, Ringaudai, Domeikava, Teleičiai, Užliedžiai, Neveronys, Linksmakalnis, Noreikiškės, Radikiai, Lapės and Giraitė (see the Fig. 3.4). This scenario reflects the subjective choices of residence of the population.

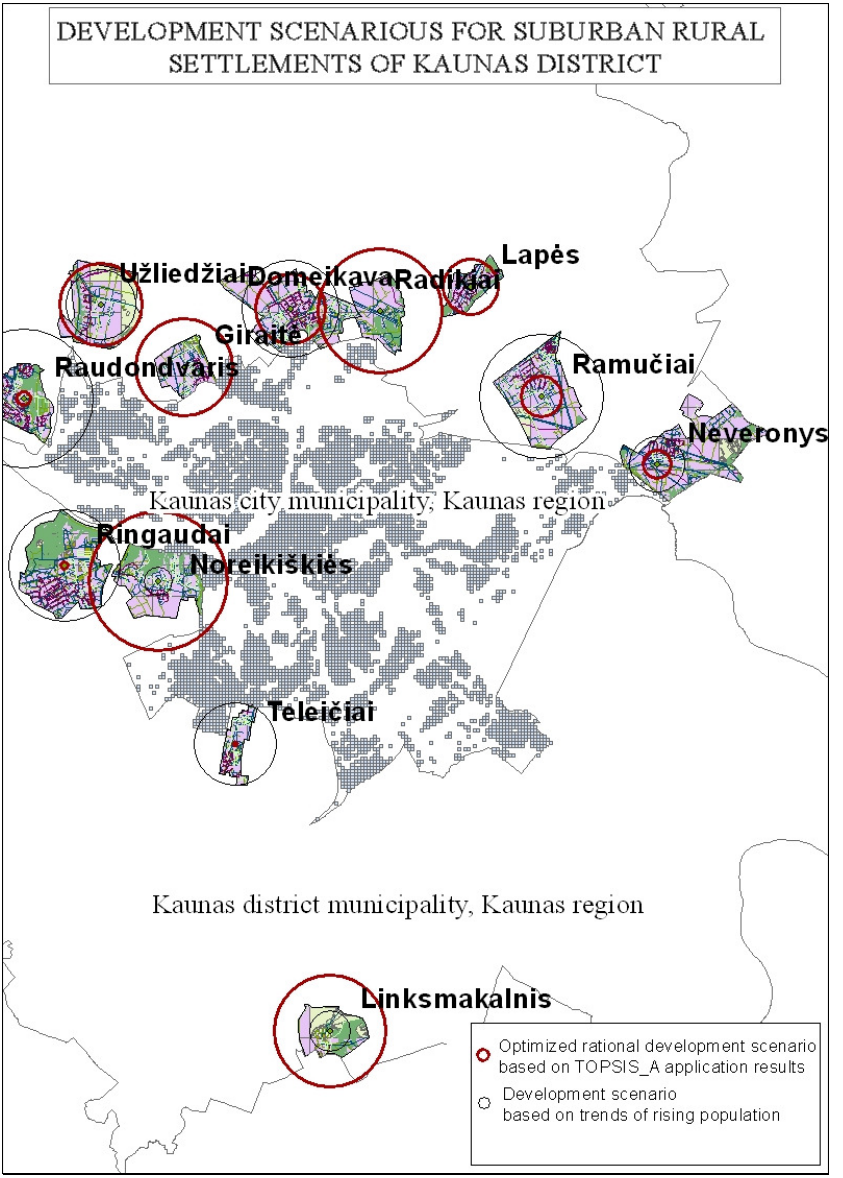

Fig. 3.4. Development scenarios for suburban rural settlements of Kaunas district

While if taking the author's developed integrated suburban residential environment quality assessment, these suburban areas of Kaunas currently have the highest potential for qualitatively expansion: Noreikiškės, Radikiai, Linksmakalnis, Giraitė, Užliedžiai, Domeikava, Lapės, Ramučiai, Neveronys, Raudondvaris, Ringaudai, Teleičiai (see the Fig. 3.4.).

3.3.3. Scenario for Klaipėda district

The territory of Klaipeda's region has some specific characteristics and exceptional conditions in terms of urban development. The coastal area is part of Klaipeda's region; this region is bordered with the Baltic Sea and Curonian Lagoon, has attractive recreational resources which are different from other regions. This situation allows attracting additional investments for seasonal houses and second home development. All this enhances the pace of territorial urbanization. And finally, the most important factor which influences urbanization in the region's territory – a major metropolitan centre, Klaipėda, has very limited territorial reserves.

While reducing a social exclusion, especially in municipal peripheral areas, the important factor is the development of the network of residential areas and strengthening the potential of residential areas. The balanced regional development of residential areas is based on regional policy. Based on the market economic conditions were are no centralized tools which would ensure a stable number of residents in residential areas would increase this number or would enhance residents' economic activity. One of the possible tools to promote the development of small towns and villages is to grant the status of the new municipal centres or parishes. This tool is not an end in itself and requires a long and careful preparation. The main aim of this tool is to help build civil society, strengthen the administrative capacity and creating favorable conditions for the economy, infrastructure and quality of life.

According to the provisions of Republic of Lithuania territory master plan, the network of residential areas is districted in Klaipėda region residential system. This network consists of the following levels of hierarchical centres: the existing parishes which are supported Vėžaičiai, Veiviržėnai, Kretingalė; parish centres – Priekulė, Dovilai and Slengiai; currently developed centres – Judrėnai, Endriejavas, Agluonėnai; possibly new formed parish centre – Plikiai. The main network of the residential areas is supported by densely built-up rural residential areas with close to 500 or more residents.

In the approved master's plan conception for the district, one of the aim is the development of residential areas, the formation of the district hierarchical polycentric network of residential areas, to ensure the most favorable social,

economic and ecological development conditions and residents' assumptions of the better quality of life.

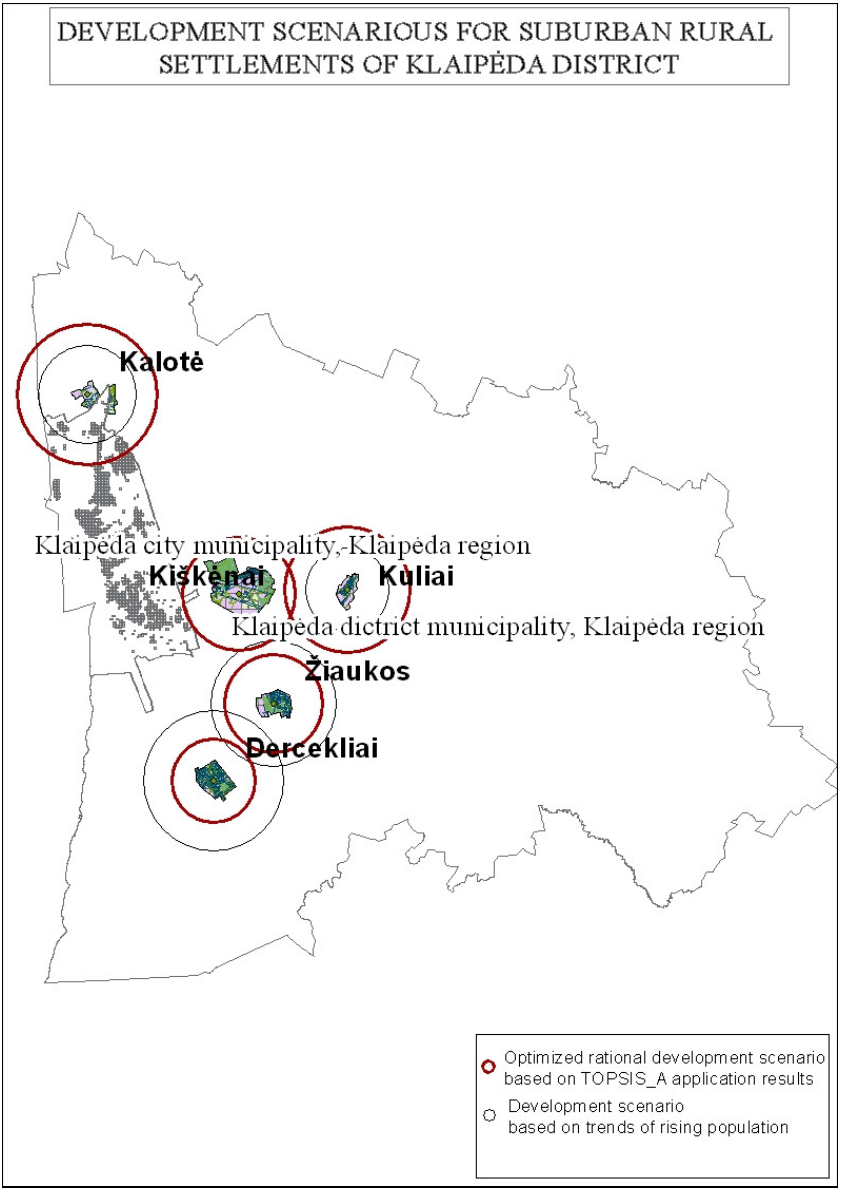

Fig. 3.5. Development scenarios for suburban rural settlements of Klaipėda district

Thus, according to the master plan of Klaipėda district, the main network of the residential areas in Klaipėda is supported by densely built-up rural residential areas with close to 500 or more residents. The priority for the potential development of rural residential areas in Klaipėda district isn't definite. The priority for the potential development is dedicated for larger settlements, which have experienced the decrease of population or slight increase during investigated period: Gargždai, Dovilai, Vežaičiai, Veiviržėnai, Kretingalė, Slengiai, Judrėnai, Endriejavas, Agluonėnai or Plikiai. This scenario reflects the choices of territory planners, specialists and other concerned parties.

According to population growth trends (taking the changes from 1989 to 211) the priority for potential expansion of suburban rural villages in the suburbs of Klaipėda would be: Dercekliai, Žiaukos, Kiškėnai, Kalotė, Kuliai (see the Fig. 3.5.). This scenario reflects the subjective choices of residence of the population.

While if taking the author's developed integrated suburban residential environment quality assessment, these suburban areas of Klaipėda currently have the highest potential for qualitatively expansion: Kalotė, Kuliai, Kiškėnai, Žiaukos and Dercekliai (see the Fig. 3.5.).

3.4. Conclusions of the third chapter

1. The application both an integrated sequence and multi-criteria decision analysis system TOPSIS_A method helped to compare all suburban settlements of Vilnius, Kaunas and Klaipėda districts separately in current research.
2. The results have been represented in form of two development scenarios for suburban rural settlements of largest Lithuanian cities' districts. The first one is optimized rational development scenario based on TOPSIS_A application results and the other development scenario is based on trends of rising population.
3. Making the comparison of optimized rational development scenario based on TOPSIS_A application results and development scenario based on trends of rising population, authors can identify three main findings: 1) the development scenarios present different trends of rural settlement development in the region, 2) the application of multi-criteria decision analysis methods could help to control rapid growth of large cities' suburbs and to sustain regional hierarchical network of suburban rural settlements, 3) in order to ensure the reliability of developed scenarios it is necessary to check the sequence of the indices with other multi-criteria decision analysis methods.

General conclusions

1. Scientific literature analysis has revealed that population migration to the cities and it suburban areas is a basis to perform research on measuring the level of quality of life and sustainability in suburban territories.
2. The main concepts, that are used in this research, shows, that ideas of the quality of the environment, the quality of life, urban vitality and the ideas of sustainability overlap with each other, though all of those relate to investigations into the relationship between the person and the environment. Author refers to quality of life making the abstract quality of life concept as concrete as possible – as quality of suburban residential environment in urban-rural interaction.
3. A new suburban residential environment is being developed due rural-urban interaction. Author has pointed out two generalized groups of the formers of the suburban residential environment: 1) urban dwellers that have moved from their urban residential environment to the rural one; 2) local residents of rural areas. New suburban residential environment creates due the resident's dissatisfaction on quality of residential environment. They are subjectively assessing the concept of suburban residential environment.

4. Urban planners generally use the real-objective, qualified indices of residential environment. In this way, they characterise the suburban residential environment and provide territorial development scenarios.

5. The indices have been selected according to Vilnius city case study with the explanation of the notion of the residential environment and the surveyed physical and functional elements, which may positively and negatively impact both residential environment quality and city residents intention to move to live to another place. Selected ten indices cover quality all settings of residential environment quality, i.e. social, economic, natural and physical (building and infrastructure) quality.

6. The difference between the used subjective and objective assessment of residential quality indicators revealed that these values frequently differ from the choice of urban residents to live in urban planner's planned suburban residential environment.

7. Based on scientific insights of the suburban residential environment quality concept and the assessment methods authors have established the conceptual model of subjectively and objectively integrated quality indices assessment of the suburban residential environment. Generalised weights of the objective and subjective evaluation values of the residential environment indices obtained by multi-criteria evaluation methods enable us to determine the sequence of integrally-based priority significance of the residential environment indices: 1) affordability of plots of land; 2) area of green planting per capita; 3) number of companies providing various services; 4) development of a communication system; 5) direct investment per capita; 6) commuting time; 7) distance to the city centre; 8) affordability of housing; 9) availability of dwelling with engineering networks; 10) density of population.

8. After the calculations performed by the multi-criteria decision analysis system applying method for all suburban settlements of Vilnius, Kaunas and Klaipėda districts, the result have been compared with the demographic tendencies there. The results have been represented in form of two development scenarios for suburban rural settlements of Vilnius, Kaunas and Klaipėda districts. The first one is optimized rational development scenario based on conceptual model application results and the other development scenario is based on trends of rising population.

9. Making the comparison of optimized rational development scenario based on application results and development scenario based on trends

of rising population, authors can identify that the application of multi-criteria decision analysis methods could help to control rapid growth of large cities' suburbs and to sustain regional hierarchical network of suburban rural settlements.

10. In further investigation the integrated quality assessment of suburban residential environment could be complemented by new indicators. So that it could it could be clustered and separately evaluated by social, economic and other aspects.

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Summary in Lithuanian

Įvadas

Problemos formulavimas

Miestai ir kaimiškosios gyvenamosios vietovės yra kintamo pobūdžio sistemos. Jos formavosi skirtingais urbanizacijos tempais, turi savo gyvavimo ciklus, veikia bendroje sudėtingoje valstybės ir regiono socialinėje-ekonominėje sistemoje ir teritorinėje erdvėje. Miestų ar kaimiškųjų gyvenamųjų vietovių kūrimosi, brandos ar nuosmukio etapai – natūralūs procesai, tačiau sisteminis požiūris į jas leidžia teigti, jog bet kurios iš paminėtų sistemų kritinis pasikeitimas gali turėti lemiamos reikšmės kitos sistemos veikimui.

Analizuojant gyvenamųjų vietovių vystymosi tendencijas Europos Sąjungoje ir Lietuvoje, stebimi ryškūs kaimiškųjų gyvenamųjų vietovių sistemos pokyčiai: kaimiškųjų vietovių nykimas, spartus gyventojų skaičiaus mažėjimas arba transformacija į priemiestines teritorijas, ateityje galintys turėti ir turintys lemiamos reikšmės miesto sistemos veikimui.

Manoma, jog pagrindinė priežastis yra ta, kad kaimiškųjų gyvenviečių gyvenamoji aplinkos kokybė neatitinka gyventojų poreikių. Tačiau, miestuose vykdytos gyventojų apklausos rezultatai rodo, jog ketvirtadalis respondentų norėtų gyventi kaime. Studentų

apklausos parodė, kad nors kaimuose ir išnyko didžioji dalis jaunimo, bet 36 proc. respondentų norėtų gyventi kaime.

Autorė daro išvadą, kad kaimiškųjų vietovių gyvenamoji aplinka yra patraukli, tačiau nepatogi ir nekokybiška. Lietuvos teritorijų planavimo dokumentuose kokybinė, o ne kiekybinė ar teritorinė gyvenamųjų vietovių plėtra akcentuojama jau nuo 2002 metų, tačiau sunkiai sekasi ją įgyvendinti tiek kaime, tiek mieste. Įsivyravo tendencija, kuomet miesto gyventojai kuria sau priimtiną gyvenamąją aplinką priemiesčiuose. Todėl galima sakyti, kad didžiųjų miestų priemiesčiuose ryškiausia miesto ir kaimo sistemų sankirta. Teorijoje tai vadinama suburbanizacija arba urbanistiniu sprogimu (‘urban sprawl’). Pačių gyventojų kuriama gyvenamoji aplinka ir jų subjektyviai suvokiama gyvenamosios aplinkos kokybė ilgainiui tampa miesto problema. Priemiesčiuose esančios kaimiškosios gyvenamosios vietovės auga, tuo tarpu didžiųjų miestų centrai tuštėja, brangsta infrastruktūros eksploatacija ir t. t.

Kaimiškųjų gyvenamųjų vietovių sistemos pasikeitimas didžiojoje dalyje Europos jau yra pripažintas. Politikai, mokslininkai ir verslo atstovai kartu dirba, kad padėtų kuo kokybiškiau atkurti kaimiškųjų gyvenamųjų vietovių sistemą naujomis socialinėmis ir ekonominėmis sąlygomis.

Mažėjančių demografinių išteklių Lietuvai būtinas naujas požiūris į miestų ir kaimiškųjų teritorijų ryšius bei šių sistemų sąveiką. Miestas negali darniai funkcionuoti be kaimiškųjų gyvenamųjų vietovių ir atvirkščiai. Todėl ir moksliniuose tyrimuose ir gyvenamųjų vietovių plėtros strategijose ieškant kokybės būtų sveikintinas tolygus požiūris į abi šias sistemas.

Darbo aktualumas

Pastarąjį dešimtmetį gyventojų skaičiaus kitimo tendencijos ir demografiniai rodikliai ypač jautriai vertinami Rytų Europos regionuose, kurie patyrė didelę gyventojų migraciją į kitas šalis. Nepaisant įgyvendintos ES struktūrinės paramos, kuri buvo skirta sparčiai gerinti sąlygas gyventi Lietuvoje, remiantis dabartinių tarptautinių tyrimų prognozėmis, šalis iki 2050 m. neteks apie 20 proc. gyventojų. Didžiąją dalį Lietuvos teritorijos užima kaimiškosios gyvenamosios vietovės. Jose gyvena trečdalis šalies gyventojų. Akivaizdu, kad būtent šiose vietovėse bus labiausiai jaučiamas gyventojų skaičiaus mažėjimas, todėl galimas kritinis pasikeitimas Lietuvos gyvenamųjų vietovių erdvinės struktūros plėtros modelyje.

Nuo 2008 m. iki 2013 m. gyventojų skaičius Lietuvos kaimuose sumažėjo 9,5 proc. Nors gyventojų skaičiaus mažėjimo tempas toks pat kaip ir miesto, tačiau kaimo vietovėse sparčiau mažėjo jaunimo iki 15 metų ir augo gyventojų skaičius kuriems virš 65 metų. Sekant šias tendencijas konstatuojama: per 2001 m.–2011 m. išnyko apie 1500 kaimų. Natūralu, kad ryškūs kaimiškųjų gyvenviečių pokyčiai tapo šiai dienai ypač aktualiu klausimu.

Tyrimo objektas

Priemiestinių kaimiškųjų gyvenamųjų vietovių funkcinės, erdvinės organizacijos (gyvenamosios aplinkos) kokybė ir jos įtaka formuojant priemiestinių kaimiškųjų vietovių tinklą.

Darbo tikslas

Darbo tikslas yra įvertinti miesto ir kaimiškųjų vietovių sistemų sąveiką, jos įtaką teritorijų planavimo dokumentų sprendiniams, planuojant tolimesnę priemiestinių gyvenamųjų vietovių plėtrą.

Darbo uždaviniai

Darbo tikslui pasiekti, suformuoti sekantys uždaviniai:

1. Apžvelgti, miestų ir šalia jų esančių kaimiškųjų vietovių ryšius, įtakojančius tiek vienų, tiek kitų funkcionavimą.
2. Apibrėžti priemiestinės gyvenamosios aplinkos sąvoką, apimant kaimo ir miesto sąveikos ryšių komponentus. Įvertinti ryšių poveikį, matuojant priemiestinės gyvenamosios aplinkos kokybę.
3. Atlikti vidinės gyventojų migracijos tarp miesto ir kaimiškųjų gyvenamųjų vietovių analizę Lietuvos didmiesčių įtakos zonoje.
4. Nustatyti objektyvius ir subjektyvius veiksnius, labiausiai įtakojančius miestų ir kaimiškųjų gyvenamųjų vietovių sąveiką ir sukurti integruotą konceptualų vertinimo modelį.
5. Pritaikyti konceptualų vertinimo modelį Lietuvos didžiųjų miestų įtakoje esančioms kaimiškosioms gyvenamosioms vietovėms ir pateikti miesto ir kaimo kokybės plėtros vertinimą gyvenamųjų vietovių ateities scenarijų forma.

Tyrimų metodika

Darbe naudoti pagrindiniai tyrimo metodai: mokslinė teorinė, statistinė, lyginamoji kelio (Path) analizė, ekspertinis vertinimas, daugiakriterinis sprendimų paramos metodas.

Mokslinė teorinė analizė autorei padėjo atskleisti dėstomą temą, apžvelgta geroji kitų šalių praktika paskatino idėjas, kurios taikytos atliekant mokslinius tyrimus kuriant ir taikant koncepcinį modelį.

Remiantis statistiniais metodais išanalizuotos vidinės gyventojų migracijos, priežastys, taikant lyginamąją kelio analizę, nustatyti pagrindiniai tiriamąjį objektą apibūdinantys veiksniai.

Remiantis ekspertiniu vertinimu nustatyti veiksnių reikšmingumai, tai yra suformuotas pagrindas konceptualiam modeliui.

Daugiakriterinio sprendimų paramos metodo TOPSIS_A pagalba sukurta racionali kokybinė plėtra lyginama su esamomis demografinėmis tendencijomis grįsta priemiestinių kaimiškųjų gyvenamųjų vietovių plėtra.

Darbo mokslinis naujumas

Miestuose yra daug veiksnių, kurie gali įtakoti žmonių gyvenimo kokybę: dirbtinai suformuota ir natūrali aplinka, judumas mieste, urbanistinė estetika, įvairių paslaugų prieinamumas ir kt. Klausimas, kokią šie veiksniai iš tiesų daro įtaką miestų plėtrai ir kaip juos tiksliau įvertinti, iki šiol yra atviras. Kai kurie gyvenimo kokybės tyrimai atliekami nacionaliniame lygmenyje, kiti – regioniniame, tačiau tik nedaugelis iš jų atliekami vietos lygmenyje. Pastaruoju lygmeniu gali būti priimamos gretimos miestui teritorijos arba kitaip – priemiesčio lygmuo, kur pasireiškia miesto ir kaimo teritorijų sąveika. Be to, apžvelgiant aukščiau minėtus tyrimus, pastebėta, kad vertindami gyvenimo kokybę mokslininkai remiasi atskirai tik subjektyviais arba objektyviais rodikliais.

Šis mokslinis darbas atspindi kaip per socialinės ir ekonominės aplinkos ypatybes, teritorinę plėtrą ir žmonių gyvenimo būdą galimai perspektyvoje plėtosis Lietuvos didžiųjų miestų priemiesčiai. Todėl ir vienas iš pagrindinių darbo tikslų yra naujas – rasti būdą kaip apjungti objektyvius teritorijų planavimo rodiklius, ir subjektyvią gyventojų nuomonę, kad vėliau jais vadovaujantis galėtumėme įvertinti bendrą gyvenimo kokybę ir jos variacijas planuojant gyvenamąją aplinką.

Darbo rezultatų praktinė reikšmė

Mokslinio darbo autorius atliktų tyrimų rezultatais bando perteikti reprezentatyvias šiuolaikinių didžiausių Lietuvos miestų priemiesčiuose esančių kaimiškųjų gyvenamųjų vietovių vystymosi tendencijas. Taigi, autorius pasiūlo būsimos teritorijų plėtros vertinimo priemonę, kuri yra vertinama vietos lygmeniu ir yra pagrįsta individų (potencialių priemiesčio gyventojų ir planuotojų) gyvenamosios aplinkos suvokimu.

Ginamieji teiginiai

1. Miestai ir kaimiškosios gyvenamosios teritorijos nėra atskiros erdvės, jie veikia bendroje sudėtingoje socialinėje-ekonominėje, gyvenamųjų vietovių erdvinės

struktūros sistemoje. Bet kurios iš paminėtų sistemų kritinis pasikeitimas gali turėti lemiamos reikšmės kitos sistemos veikimui.

2. Lietuvoje bendrųjų planų rengimo kokybė pagerėtų, jei gyvenamųjų vietovių ateities plėtros koncepcijos būtų paremtos miesto ir kaimiškųjų vietovių sistemos (ir atvirkščiai)sąveikos įtakos vertinimu.

Darbo rezultatų aprobavimas

Autorė atliktos analizės bei mokslinių tyrimų, susijusių su disertacijos tema rezultatus aprašė 10 mokslinių straipsnių: iš jų 2 publikuoti Thomson Reuters Web of Knowledge (ISI Web of Science) duomenų bazėse esančiuose žurnaluose, 2 straipsniai tarptautinių konferencijų leidiniuose, referuojamuose Thomson Reuters duomenų bazėje Proceedings, 2 straipsniai kitų tarptautinių duomenų bazių leidiniuose, 4 straipsniai kituose recenzuojamuose mokslo leidiniuose.

Pranešimai tarptautinėse mokslo konferencijose/kongresuose:

1. Lazauskaitė, D. Quality Analysis of Vilnius City Suburban Spatial Development. 9th International Conference Environmental Engineering, May 22–23, 2014, Vilnius, Lithuania.
2. Lazauskaitė, D. The assessment of quality of life in sub peripheral urban areas. IV EUGEO Congress 2013, September 5–7, 2013, Rome, Italy.

Pranešimai mokslo konferencijose:

1. Levikovaitė L.; Lazauskaitė D. Gyvenimo kokybės vertinimas Vilniaus miesto pavyzdžiu. 16-oji Lietuvos Jaunųjų mokslininkų konferencija: Mokslas – Lietuvos ateitis, 2013 balandžio 11 d., Vilnius, Lietuva.
2. Lazauskaitė, D.; Palevičius V. Gyvenamųjų teritorijų sistemos plėtros modelio sukūrimas taikant diagnostinio sprendimų priėmimo metodą. Antroji jaunųjų mokslininkų konferencija. Fizinių ir technologijos mokslų tarpdalykiniai tyrimai, 2012 m. vasario 14 d., Vilnius, Lietuva.
3. Lazauskaitė D. Europos regionai. Respublikinė Civilinės inžinerijos ir geodezijos konferencija, 2011 m. spalio 21 d. Vilnius, Lietuva.

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1. Lazauskaitė, D. Tarptautinės ESPON‘ 2013 programos patirties pamokos, plėtojant Lietuvos regionus. Konferencija. Lietuvos regionai: 10 metų Europos Sąjungoje, 2014 m. rugsėjo 11 d., Marijampolė, Lietuva.
2. Lazauskaitė, D. ESPON 2013: The European Observation Network of Territorial Development and Cohesion. International meeting of VISBY project: Capacity building in sustainable urban planning and development in Lithuania, Russia, Sweden and Ukraine, April 24, 2012, Vilnius, Lithuania.
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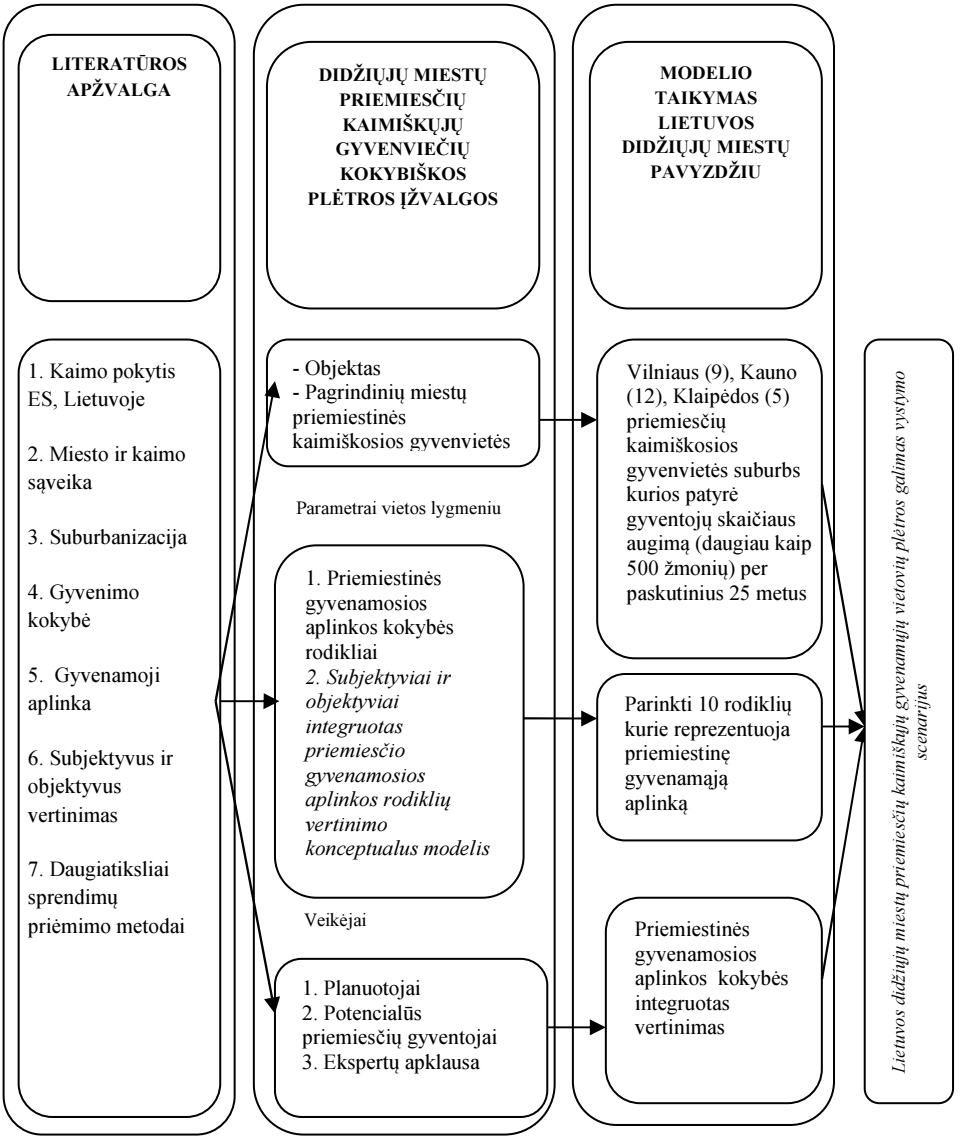
Disertacijos struktūra

Disertaciją sudaro įvadas, trys skyriai, literatūros šaltiniai, autoriaus publikacijų disertacijos tema sąrašas, santrauka lietuvių kalba.

Mokslinis darbas apima 120 puslapių. Darbe pateikiama 18 lentelių ir 15 paveikslai. Tekste naudotos literatūros sąrašas kartu su autoriaus publikacijomis apima 162 šaltinius. Trumpas pagrindinių disertacijos dalių ir priedų aprašymas:

1. Miesto ir kaimo sąveikos pokyčių apžvalga ir kokybiškos teritorijų plėtros perspektyvų paieška Europos Sąjungoje ir Lietuvoje;
2. Subjektyviai ir objektyviai integruotas priemiesčio gyvenamosios aplinkos rodiklių vertinimo konceptualus modelis;
3. Didžiųjų miestų priemiesčių kaimiškųjų gyvenviečių plėtros perspektyviniai scenarijai.

Darbo pabaigoje pridedamos išvados, naudoti literatūros šaltiniai. Taip pat pateikiamas autoriaus publikacijų sąrašas. Disertacijos struktūros schema pateikiama Nr. S1paveiksle.



S1 pav. Disertacijos struktūros schema

1. Miesto ir kaimo sąveikos pokyčių apžvalga ir kokybiškos teritorijų plėtros perspektyvų paieška Europos Sąjungoje ir Lietuvoje

Pirmas skyrius skirtas mokslinių darbų disertacijos tema apžvalgai, esamai miesto ir kaimiškųjų gyvenamųjų vietovių sąveikos analizei Europoje ir Lietuvoje.

Miestai ir kaimiškosios gyvenamosios vietovės yra kintamos sistemos. Jos formavosi skirtingais urbanizacijos laikotarpiais, turi savo gyvavimo ciklus, veikia bendroje sudėtingoje valstybės ir regiono socialinėje-ekonominėje sistemoje ir teritorinėje erdvėje. Miestų ar kaimiškųjų gyvenamųjų vietovių kūrimosi, brandos ar nuosmukio etapai – natūralūs procesai, tačiau galima spėti, kad bet kurios iš paminėtų sistemų kritinis pasikeitimas gali turėti lemiamos reikšmės kitos sistemos veikimui. Sistemų pasikeitimas siejamas su kritiniu žmogiškųjų išteklių sumažėjimu. Tam tikrų teritorijų depopuliacija didintų atskirų šalies teritorijos dalių vystymosi netolygumus, o tai neatitiktų darnios plėtros principų įgyvendinimui.

Pastarąjį dešimtmetį gyventojų skaičiaus kitimo tendencijos ir demografiniai rodikliai ypač jautriai vertinami Rytų Europos regionuose, kurie patyrė didelę gyventojų migraciją į kitas šalis. Nepaisant įgyvendintos ES struktūrinės paramos kuri buvo skirta sparčiai gerinti sąlygas gyventi Lietuvoje, remiantis dabartinių tarptautinių tyrimų prognozėmis, šalis iki 2050 m. neteks apie 20 proc. gyventojų. Didžiąją dalį Lietuvos teritorijos užima kaimiškosios gyvenamosios vietovės. Jose gyvena trečdalis šalies gyventojų. Akivaizdu, kad būtent šiose vietovėse bus labiausiai jaučiamas gyventojų skaičiaus mažėjimas, todėl galimas kritinis šios sistemos pasikeitimas ir nemenka sumaištis Lietuvos gyvenamųjų vietovių erdvinės struktūros plėtros modelyje.

Kritinis žmogiškųjų išteklių sumažėjimas nutolusiose nuo miestų kaimiškosiose teritorijose blogina viso regiono socio-ekonominę aplinką, mažėja regionų plėtros potencialas, konkurencingumas. Nesant gyventojų, žemė gyvenamosiose vietovėse tampa apleista, ilgainiui praranda savo vertę. Didmiesčiai, ypač jų centrai linkę tuštėti, nes miestų sistemos veikla ir joje egzistuojantys ištekliai transformuojasi į kitą sistemą (persikelia į priemiesčius). Kaimiškųjų gyvenamųjų vietovių sistemos pasikeitimas didžiojoje dalyje Europos (ir Lietuvoje) jau yra pripažintas. Politikai, mokslininkai ir verslo atstovai kartu dirba, kad padėtų kuo kokybiškiau spręsti miestų ir kaimų sistemos darnų veikimą, kad sustabdytų kaimiškųjų gyvenamųjų vietovių nykimą ir dėl to gresiantį miestų sistemos disbalansą. Mažėjant demografiniams ištekliams, teritorijų planavimo politikoje Lietuvai būtinas naujas požiūris į miestų ir kaimiškųjų teritorijų ryšius bei šių sistemų sąveiką. Lietuvos teritorijų planavimo dokumentuose kokybinė, o ne kiekybinė ar teritorinė gyvenamųjų vietovių plėtra akcentuojama jau nuo 2002 metų, tačiau sunkiai įgyvendinama. Remiantis Vakarų šalių gerąja patirtimi, šiuo metu kokybinė miesto ir kaimiškųjų gyvenamųjų vietovių plėtra turėtų būti pagrįsta miesto ir kaimiškųjų vietovių sistemų tarpusavio sąveika.

Planuojant gyvenviečių plėtrą Lietuvoje, trūksta gyvenamosios aplinkos kokybės vertinimo metodikos, įvertinančios miestų ir šalia jų esančių kaimiškųjų teritorijų ryšius, įtakojančius tiek vienų, tiek kitų funkcionalumą. Todėl autorė savo darbu pasirinko nagrinėti miesto ir kaimo gyvenamosios aplinkos kokybės vertinimo metodiką.

Galimybė suderinti objektyvius rodiklius ir subjektyvią potencialių gyventojų nuomonę leistų pagerinti miesto ir kaimo gyvenamosios aplinkos kokybės vertinimą priimant racionalesnius teritorijų planavimo sprendimus.

2. Subjektyviai ir objektyviai integruotas priemiesčio gyvenamosios aplinkos rodiklių vertinimo konceptualus modelis

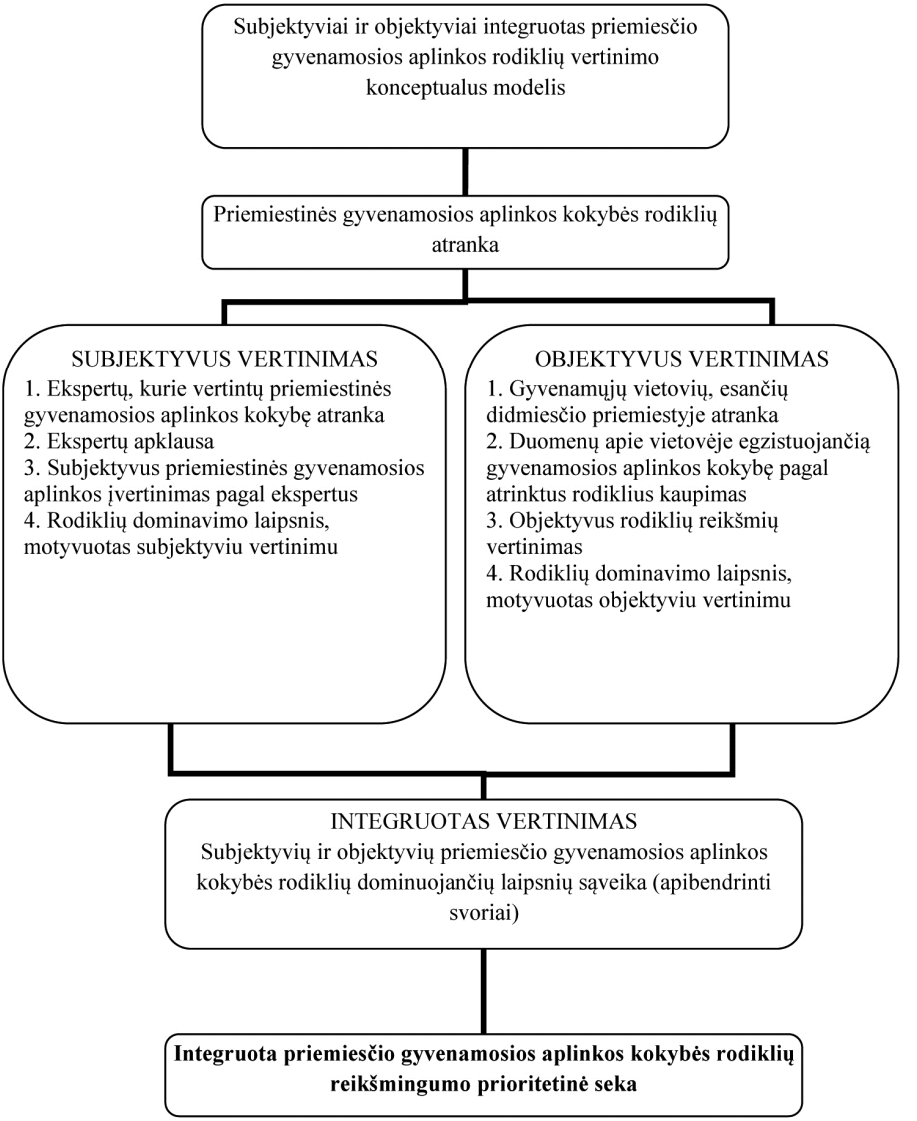
Antras skyrius skirtas konceptualiam miesto ir kaimo gyvenamosios aplinkos kokybės vertinimo integruotam modeliui sukurti, apjungt objektyvius rodiklius ir subjektyvią potencialių gyventojų nuomonę.

Priemiestinės gyvenvietės yra sudėtingų miesto ir kaimo sistemų sankirtoje. Jose esanti gyvenamoji aplinka, turi atitikti potencialių gyventojų ir planuotojų keliamus reikalavimus. Priemiestinę gyvenamąją aplinką sunku aprašyti vienu rodikliu, nuo kurio priklausytų jos planavimo kokybė. Todėl autorė pasinaudojo, gyventojų apklausų rezultatais, ekspertų nuomone, duomenų grupavimu ir subjektyviu, objektyviu bei integruotu priemiestinės gyvenamosios aplinkos vertinimu. Kiekybiniams metodams už pagrindą pasirinkti statistinių duomenų ir ekspertų vertinimai, juos apjungiant į vieną vertinimo kriterijų normalizuotų rodiklių ir jų svorių dėka.

Pasirinkti rodikliai apima visus gyvenamosios aplinkos parametrus: parametrus iš socialinės, ekonominės, gamtinės ir fizinės aplinkos (statyba ir infrastruktūra. Žemiau pateikiamas jų sąvadas (S1 lentelė) bei detalus aprašymas.

S1 lentelė. Pasirinkti rodikliai priemiesčio gyvenamosios aplinkos kokybei vertinti

Nr.	Rodikliai	Reikšmės matas
1.	Gyventojų tankumas	Gyventojų tankis, žmonių/ha.
2.	Susisiekimo sistemos išvystymas	Gatvių/kelių tankis, km/ km²
3.	Žaliasis plotas tenkantis gyventojui	Vienam gyventojui tenka žaliųjų plotų, km²
4.	Susisiekimo laikas	Didmiesčio centro pasiekiamumas, min.
5.	Atstumas iki miesto centro	Atstumas nuo vietovės centro iki didmiesčio centro, km
6.	Įvairias paslaugas teikiančios įmonės/įstaigos	Įvairias paslaugas teikiančių įmonių/įstaigų skaičius, vnt.
5.	Tiesioginės investicijos tenkančios gyventojui	Tiesioginės ES struktūrinių paramos/vietos fondų 2004/2015 investicijos tenkančios vienam gyventojui, EUR
8.	Gyvenamojo būsto kainos prieinamumas	Dabartinės vidutinės metinės butų pardavimo kainos ir disponuojamų vidutinių mėnesinių vieno namų ūkio pajamų proporcija, EUR
9.	Aprūpinimas inžineriniais tinklais	Inžinerinių tinklų, tokių kaip dujų, elektros, vandens tankis teritorijoje, km/ km²
10.	Žemės kaimos prieinamumas	Dabartinės vidutinės metinės žemės pardavimo kainos ir disponuojamų vidutinių mėnesinių vieno namų ūkio pajamų proporcija, EUR



S2 pav. Subjektyviai ir objektyviai integruotas priemiesčio gyvenamosios aplinkos rodiklių vertinimo konceptualus modelis

Žemos ir prieinamesnės pirkėjams žemės kainos skatina žmones riktis sklypus miesto priemiesčiuose. Tokiu būdu skatinama padrika ne tik miesto plėtra. Žemos kainos nulemta naujai kuriama gyvenamoji aplinka priemiestinėse kaimiškose gyvenamosiose vietovėse nėra darnos ir integruotumo garantas. Želdynai mieste atlieka žmogui labai svarbias urba-ekologinio kompensavimo, techninę apsauginę ir architektūrinę funkcijas, todėl jų gausa vienareikšmiškai pagerintų gyvenamosios aplinkos kokybę. Paslaugų ir prekių įvairovė garantuoja geresnį gyventojų socialinių poreikių tenkinimą. Visuomet patogiau gyventi vietoje, kur teikiamas kuo didesnis įvairių paslaugų spektras. Gerinant visuomeninį transportą: padidinant maršrutų skaičių, kad būtų aptarnaujamos ir miesto priemiesčių teritorijos ir maršrutų dažnį, didėtų tikimybė, kad priemiesčio gyventojai atsisakys kelionių nuosavais automobiliais. Racionaliu visuomenės lėšų paskirstymu ir kuriant palankias sąlygas kuo didesnėms investicijoms pritraukti, būtų siekiama darnios priemiestinių kaimiškųjų gyvenviečių plėtros ir miesto ir kaimo sistemų darnaus veikimo.

Susisiekimo laikas, skaičiuojamas nuo gyvenvietės iki miesto centro (kaip gyventojų darbo vietų centro). Kuo susisiekimo laikas tarp šių svarbių atskaitos taškų yra trumpesnis, tuo pasirinkta gyvenamoji aplinka yra patrauklesnė. Atstumas nuo miesto centro – parodo kaip racionaliai yra suformuotas ryšys tarp miesto ir kaimo sistemų. Miesto centras yra suprantamas kaip didžiausias traukos centras miesto įtakos zonose esančioms teritorijoms. Kuo gyvenamoji aplinka yra arčiau didžiojo traukos centro, tuo yra kompaktiškesnis miestas, o vėliau ir besiplečiantys priemiesčiai. Žemos ir prieinamesnės pirkėjams pastatų kainos skatina žmones riktis gyventi miesto priemiesčiuose. Žemos kainos nulemta naujai kuriama gyvenamoji aplinka priemiestinėse kaimiškose gyvenamosiose vietovėse nėra darnos ir integruotumo garantas.

Inžinerinių tinklų prieinamumas parodo gyvenamosios vietovės aptarnavimą inžineriniais tinklais. Kuo intensyvumas didesnis – tuo didesnė tikimybė susikurti geresnę gyvenamąją aplinką. Gyventojų tankumas aprašomas kaip gyvenamosios vietovės darnumo esmė. Jis parodo gyvenamosios vietovės patrauklumą ir racionalų jos teritorijų panaudojimą. Jei gyvenamoji aplinka maksimaliai tenkintų gyventojus, vadinasi gyvenimo sąlygos būtų labai teigiamos, todėl esami gyventojai iš jos nesikraustytų į kitą vietą, o naujiem gyventojams ji būtų ypač patraukli.

3. Didžiųjų miestų priemiesčių kaimiškųjų gyvenviečių plėtros perspektyviniai scenarijai

Remiantis mokslinės literatūros analizės rezultatais, nustatyta, kad darnaus miesto vystymosi uždavinių formalizavimui ir sprendimui labai tinka daugiatiksliai sprendimų priėmimo metodai, operuojantys kiekybine informacija apie rodiklius. Todėl trečias skyrius skirtas konceptualaus modelio eksperimentiniam taikymui, pasitelkiant daugiakriterinį TOPSIS_A metodą. Vilniaus, Kauno ir Klaipėdos miestų įtakoje esančių kaimiškųjų gyvenamųjų vietovių kokybinės plėtros įvertinimas pateikiamas sukurtų ateities plėtros scenarijų forma.

Planuojant į kurias kaimiškąsias gyvenamąsias vietoves investuoti gerinant jų gyvenamosios aplinkos kokybę tikintis, kad darniai plėtosis didžiojo miesto priemiestis ir kartu bus patenkinti potencialių gyventojų subjektyvūs poreikiai yra problematiška.

Konceptualaus modelis padeda integruotai įvertinti didžiųjų miestų priemiesčiuose esančių kaimiškųjų gyvenamųjų vietovių gyvenamosios aplinkos kokybę.

Turint integruotus rodiklių svorius bei jų prioritetinę reikšmingumo seką (1, 2 skyriai) buvo nustatyta, kokio pavidalo yra kiekvienas iš rodiklių. Geriausios maksimizuojamųjų rodiklių reikšmės yra didžiausios, minimizuojamų – mažiausios.

Nustatomi teigiami ir neigiami idealūs variantai maksimizuojamųjų ir minimizuojamųjų rodiklių aibėje. Toliau nustatomas kiekvienos alternatyvos atstumas iki teigiamai ir neigiamai idealaus varianto. Galiausiai yra nustatomas santykinis kiekvienos alternatyvos atstumas iki idealiojo varianto. Pagal gautas santykinius kiekvienos alternatyvos atstumus yra sudaroma alternatyvų prioritetinė eilė. Geriausia alternatyva yra ta, kurios teigiama santykinio atstumo reikšmė yra didžiausia.

Įvertinus didžiųjų Lietuvos miestų priemiesčiuose (miestų rajonų ribose) didėjančių gyvenviečių augimą atrinktos kaimiškosios gyvenvietės, kuriose gyventojų skaičius sparčiai didėja (padidėjo 500 gyv.). Šios gyvenvietės skaičiavimuose prilygintos alternatyvoms, kurias nulemia 10 rodiklių (žiūr. 2 skyrių). Sprendžiant artumo idealiam taškui metodu, vietoj visų plėtotinų gyvenviečių paėmus tik tris ar dvi geriausias ir atlikus perskaičiavimą, net gi nekeičiant pradinių duomenų, nors prioritetinė eilutė ir nekis, tačiau skaitiniai rezultatai bus gaunami visiškai skirtingi.

Skaitmeniniai kiekvienos alternatyvos tarpusavio reikšmingumai yra labai svarbūs, nes pagal šias reikšmes nustatomas iš kelių sintezuojamų alternatyvų sudaromas variantas. Neįvertinus jų prarandamas rezultato tikslumas ir patikimumas.

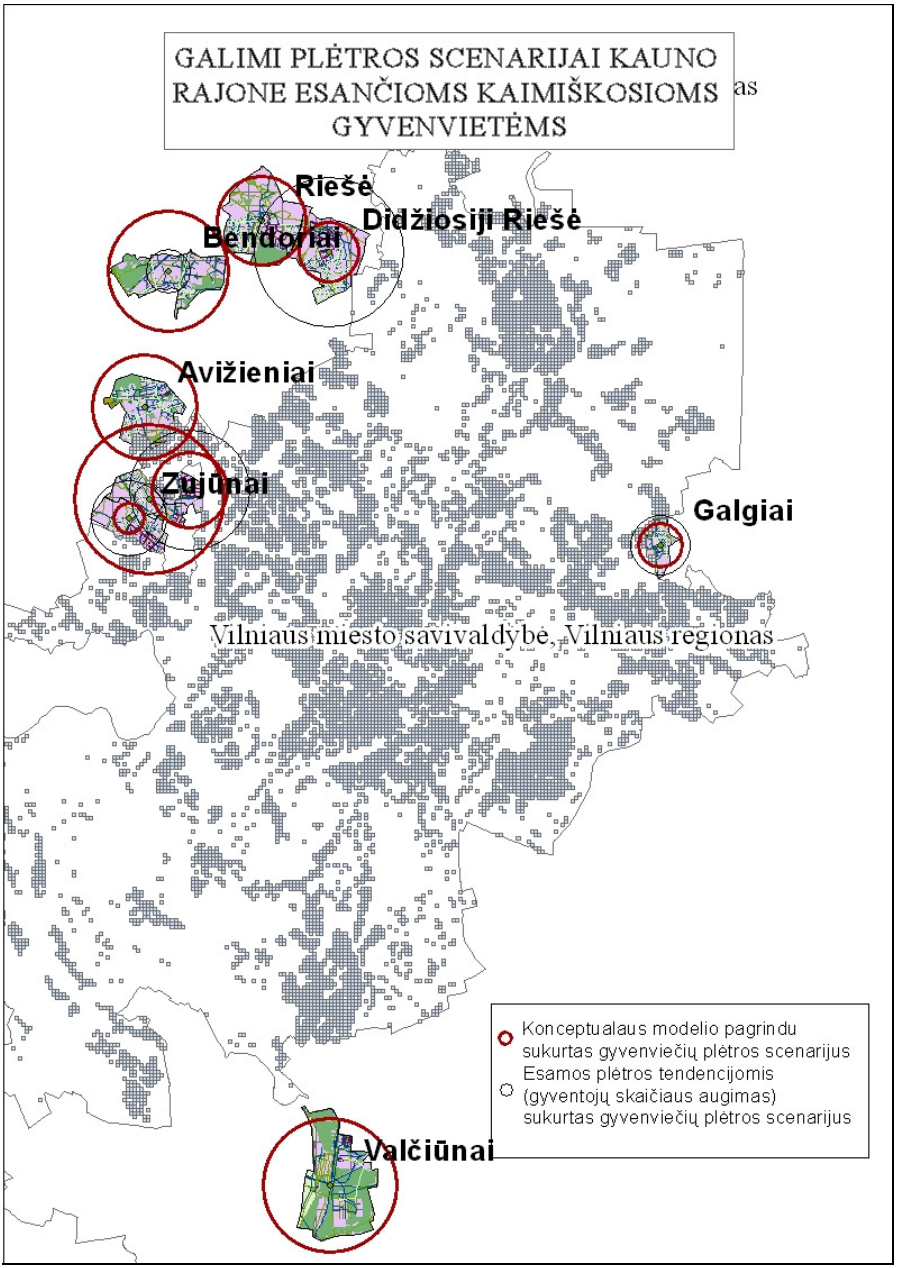
Remiantis vertinimo rezultatais, kuriamas priemiesčių kaimiškųjų gyvenamųjų vietovių plėtros galimas vystymo scenarijus. Scenarijus palyginamas su esamomis demografinėmis tendencijomis bei didmiesčių rajonų bendraisiais planais grįsta priemiestinių kaimiškųjų gyvenamųjų vietovių plėtra.

Scenarijų palyginimo vizualizacijos yra pateiktos S3, S4 ir S5 paveiksluose, kurie buvo sukurti naudojantis geografine informacine sistema (Esri's ArcGIS). Žemiau pateikiami scenarijų aprašymai.

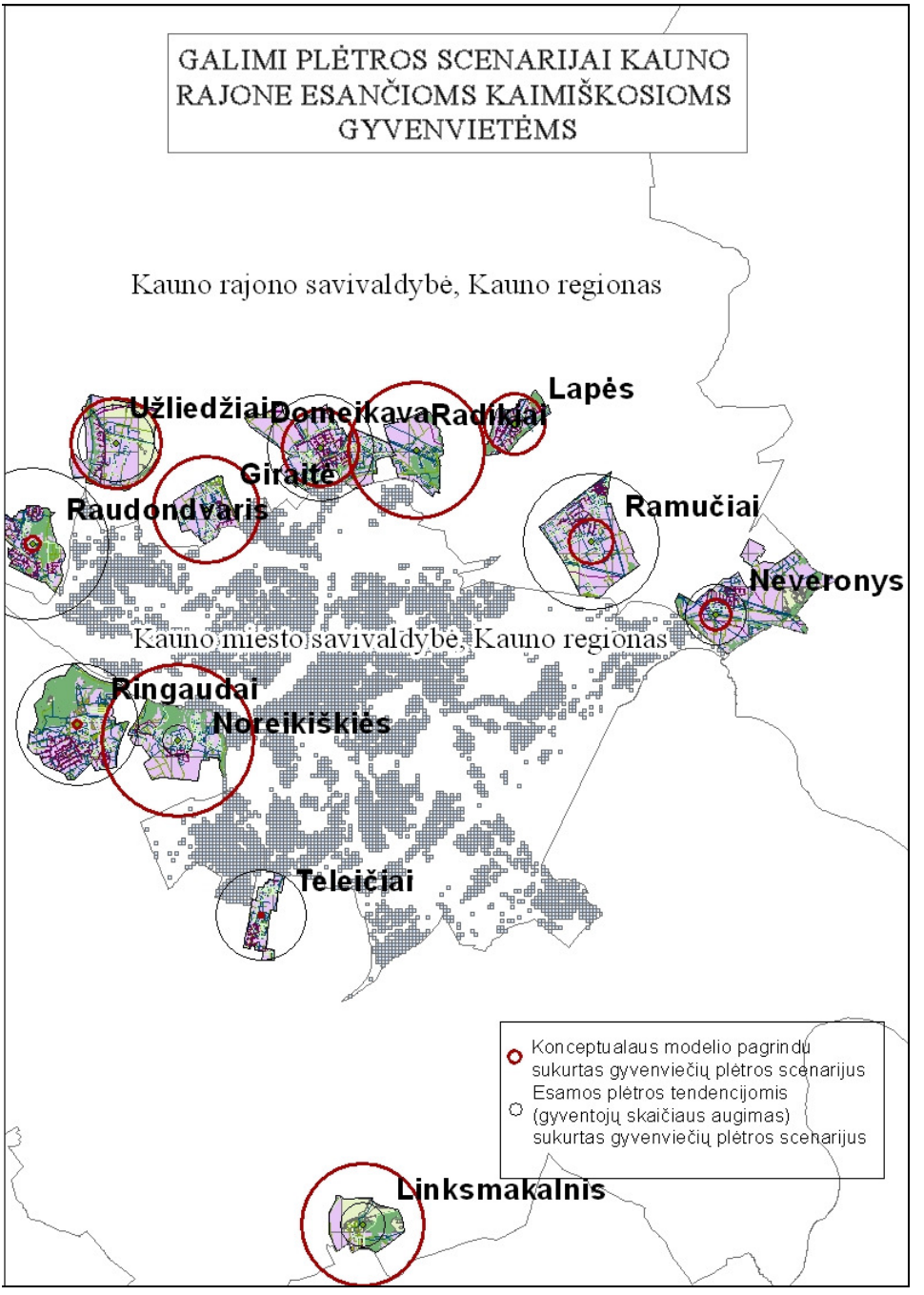
Pagal Vilniaus rajono bendrąjį planą potencialiausios plėtrai priemiestinės kaimiškosios gyvenvietės Vilniaus rajone prioritetine tvarka būtų: Didžioji Riešė, Zujūnai, Galgiai, Bendoriai, Riešė ir Valčiūnai. Šis scenarijus išreiškia teritorijų planuotojų, specialistų bei suinteresuotų šalių pasirinkimą.

Pagal gyventojų skaičiaus augimo tendencijas (imant pokytį nuo 1989–2011) potencialiausios plėtrai priemiestinės kaimiškosios gyvenvietės Vilniaus priemiestyje prioritetine tvarka būtų: (S3 pav.). Šis scenarijus išreiškia gyventojų subjektyvų gyvenamosios vietos pasirinkimą.

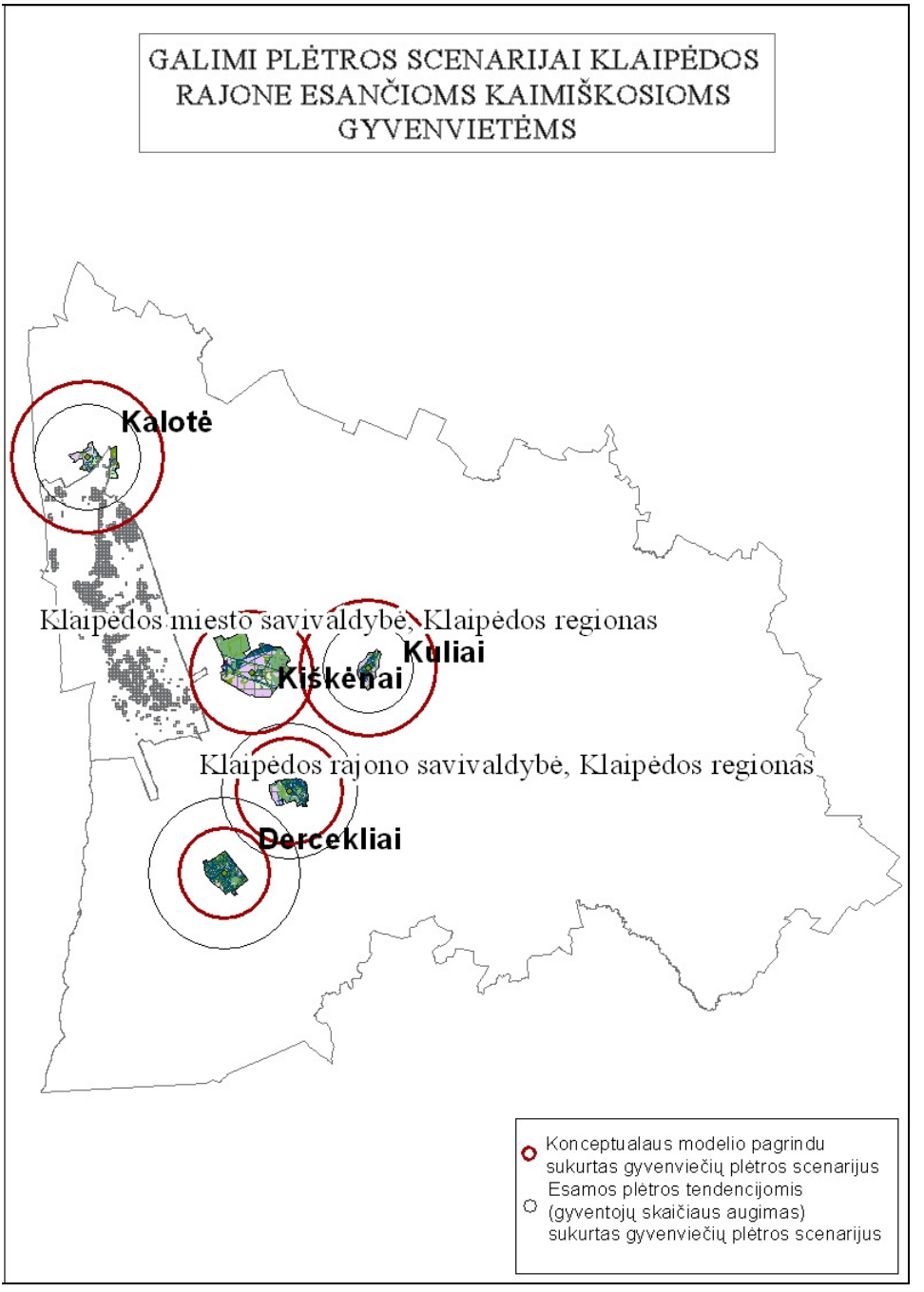
Tuo tarpu, pasitelkus autorės sukurtą integruotą priemiestinės gyvenamosios aplinkos kokybės vertinimą, potencialiausios kokybiškai plėtrai Vilniaus priemiestyje pirmiausiai būtų: Anteženiai, Valčiūnai, Bendoriai, Avižieniai, Riešė, Gineitiškės, Didžioji Riešė, Galgiai ir Zujūnai (S3 pav.).



S3 pav. Galimi plėtros scenarijai Vilniaus rajone esančioms kaimiškosioms gyvenvietėms



S4 pav. Galimi plėtros scenarijai Kauno rajone esančioms kaimiškosioms gyvenvietėms



S5 pav. Galimi plėtros scenarijai Klaipėdos rajone esančioms kaimiškosioms gyvenvietėms

Pagal Kauno rajono bendrąjį planą potencialiausios plėtrai priemiestinės kaimiškosios gyvenvietės Kauno rajone prioritetine tvarka būtų: Domeikava, Raudondvaris, Neveronys, Ramučiai, Ringaudai, Giraitė, Linksmakalnis ir Užliedžiai. Šis scenarijus išreiškia teritorijų planuotojų, specialistų bei suinteresuotų šalių pasirinkimą.

Pagal gyventojų skaičiaus augimo tendencijas (imant pokytį nuo 1989–2011) potencialiausios plėtrai priemiestinės kaimiškosios gyvenvietės Kauno priemiestyje prioritetine tvarka būtų: Raudondvaris, Ramučiai, Ringaudai, Domeikava, Teleičiai, Užliedžiai, Neveronys, Linksmakalnis, Noreikiškės, Radikiai, Lapės ir Giraitė (S4 pav.). Šis scenarijus išreiškia gyventojų subjektyvų gyvenamosios vietos pasirinkimą.

Tuo tarpu, pasitelkus autorės sukurtą integruotą priemiestinės gyvenamosios aplinkos kokybės vertinimą, potencialiausios kokybiškai plėtrai Kauno priemiestyje pirmiausiai būtų: Noreikiškės, Radikiai, Linksmakalnis, Giraitė, Užliedžiai, Domeikava, Lapės, Ramučiai, Neveronys, Raudondvaris, Ringaudai, Teleičiai (S4 pav.).

Pagal Klaipėdos rajono bendrąjį planą, atraminį gyvenamųjų vietovių tinklą papildo kompaktiškai užstatytos kaimo gyvenamosios vietovės, turinčios arti 500 ir daugiau gyventojų.

Prioritetiškumas galimai kaimiškųjų gyvenamųjų vietovių plėtrai Klaipėdos rajone nėra tiksliai nustatytas. Galima plėtra numatoma didesnėms gyvenvietėms, kurios patyrė gyventojų skaičiaus mažėjimą arba nežymų augimą per analizuojamą laikotarpį: Gargždai, Dovilai, Vežaičiai, Veiviržėnai, Kretingalė, Slengiai, Judrėnai, Endriejavas, Agluonėnai arba Plikiai. Šis scenarijus išreiškia teritorijų planuotojų, specialistų bei suinteresuotų šalių pasirinkimą.

Pagal gyventojų skaičiaus augimo tendencijas (imant pokytį nuo 1989–2011) potencialiausios plėtrai priemiestinės kaimiškosios gyvenvietės Klaipėdos priemiestyje prioritetine tvarka būtų: Dercekliai, Žiaukos, Kiškėnai, Kalotė, Kuliai (S5 pav.). Šis scenarijus išreiškia gyventojų subjektyvų gyvenamosios vietos pasirinkimą.

Tuo tarpu, pasitelkus autorės sukurtą integruotą priemiestinės gyvenamosios aplinkos kokybės vertinimą, potencialiausios kokybiškai plėtrai Klaipėdos priemiestyje pirmiausiai būtų: Kalotė, vėliau Kuliai, Kiškėnai, Žiaukos ir Dercekliai (S5 pav.).

Bendrosios išvados

1. Mokslinės literatūros apžvalga parodė, kad gyventojų migracija į miestus ir jų priemiestines teritorijas yra pagrindas atlikti mokslinius tyrimus, įvertinti gyvenimo kokybės lygį ir plėtros darną priemiestinėse teritorijose.
2. Pagrindinių sąvokų, naudojamų moksliniame darbe, apžvalga rodo, kad aplinkos kokybės, gyvenimo kokybės, miesto gyvybingumo ir darnumo idėjos stipriai siejasi viena su kita per asmens ir aplinkos santykį. Moksliniame darbe naudojama sukonkretinta gyvenimo kokybės sąvoka, kuri apibrėžiama vertinant priemiestinę gyvenamąją aplinką per miesto ir kaimo tarpusavio ryšių sąveiką.
3. Dėl miesto ir kaimo sąveikos kuriasi nauja priemiestinė gyvenamoji aplinka. Apibendrinant, yra išskiriamos dvi, labiausiai priemiesčio gyvenamosios

aplinkos formavimąsi įtakojančios žmonių grupės: 1) miestų gyventojai, kurie iškeitė miesto gyvenamąją aplinką į kaimiškąją; 2) vietiniai priemiestinių kaimo gyvenviečių gyventojai. Nauja priemiestinė gyvenamoji aplinka kuriasi dėl gyventojų nepasitenkinimo esama miesto gyvenamąja aplinka. Jie subjektyviai vertina priemiestinę gyvenamąją aplinką.

4. Teritorijų planuotojai dažniausiai naudoja realias, kiekybiškai išreikštas (objektyvias) rodiklių reikšmes. Tokiu būdu jie apibūdina priemiestinės gyvenamosios aplinkos kokybę ir numato vietovių plėtros scenarijus.

5. Gyvenamosios aplinkos kokybės vertinimo rodikliai buvo kuriami Vilniaus miesto pavyzdžiu, gyventojų apklausa tiriant gyvenamosios aplinkos sąvoką bei funkcinius ir fizinius aplinkos elementus. Nustatyta, kad ištirti elementai gali teigiamai ar neigiamai paveikti gyvenamosios aplinkos kokybę ir įtakoti miestiečių ketinimą persikelti gyventi į priemiestį. Pagal tai, atrinkta 10 rodiklių, kurie bendrai apima gyvenamosios aplinkos parametrus, apibūdinančius socialinės, ekonominės, gamtinės ir fizinės (statybos ir infrastruktūros) aplinkos kokybę.

6. Subjektyvus ir objektyvus gyvenamosios aplinkos kokybės rodiklių vertinimas parodė, kad objektyvių rodiklių reikšmės ir jų taikymas planavime skiriasi nuo miestiečių subjektyvaus pasirinkimo gyventi priemiestyje ir planuotojų priemiestinės gyvenamosios aplinkos kokybės interpretavimo.

7. Remiantis pagrįstomis įžvalgomis apie skirtingą priemiesčio gyvenamosios aplinkos kokybės sampratą ir galimus vertinimo metodus, sukurtas konceptualus priemiesčio gyvenamosios aplinkos kokybės vertinimo modelis, integruojantis subjektyvius ir objektyvius vertinimo rodiklius, nustatyti jų reikšmių svoriai, kurių pagrindu sudaryta prioritetinė rodiklių seka: 1) žemės kainos prieinamumas, 2) žaliasis plotas, tenkantis vienam gyventojui 3)įvairias paslaugas teikiančių įmonių/įstaigų skaičius, 4) susisiekimo sistemos išvystymas, 5) tiesioginės investicijos tenkančios gyventojui, 6) susisiekimo laikas, 7) atstumas iki miesto centro, 8) gyvenamojo būsto kainos prieinamumas, 9) aprūpinimas inžineriniais tinklais, 10) gyventojų tankumas.

8. Taikant pasirinktą daugiatikslių sprendimų paramos metodą sudaryti Vilniaus, Kauno ir Klaipėdos miestų įtakoje esančių kaimiškųjų gyvenamųjų vietovių plėtros scenarijai: 1) konceptualaus modelio scenarijus, pagrįstas integruotu priemiestinės gyvenamosios aplinkos kokybės vertinimu; 2) scenarijus, pagrįstas dabartinėmis demografinėmis tendencijomis.

9. Lyginant scenarijus nustatyta, kad taikant siūlomą konceptualųjį modelį, galima integruotai įvertinti didžiųjų miestų priemiesčiuose esančių kaimiškųjų gyvenamųjų vietovių gyvenamosios aplinkos kokybę ir priimti racionalius, darnios didmiesčių plėtros sprendimus, kurie įvertintų objektyvią planuotojų ir subjektyvią gyventojų nuomonę. Tai leistų efektyviau planuoti priemiestines didmiesčių zonas ir taip pagerinti miestų ir kaimiškųjų gyvenamųjų vietovių bendrųjų planų rengimo kokybę.

10. Tolimesniuose tyrimuose integruotą priemiestinės gyvenamosios aplinkos rodiklių reikšmingumo seką galima būtų papildyti rodikiais, vėliau juos klasterizuoti, kad priemiestinės gyvenamosios aplinkos kokybę galima būtų atskirai įvertinti socialiniu, ekonominiu ir kitais aspektais.

Annexes[1]

Annex A. Collection of data on indices regarding the condition of quality of selected suburban areas.
Annex B. Example of Expert survey questionnaire.
Annex C. The co-authors agreements for providing the material of the joint publications in the doctoral dissertation.
Annex D. Copies of scientific publications by the author on the topic of the dissertation.

[1]Annexes are available in attached CD.

Dovilė LAZAUSKAITĖ

QUALITY ANALYSIS AND INTEGRATED ASSESSMENT OF RESIDENTIAL ENVIRONMENT OF DEVELOPING SUBURBAN SETTLEMENTS

Daktaro disertacija

Technologijos mokslai,
statybos inžinerija (02T)

PRIEMIESTINIŲ VIETOVIŲ GYVENAMOSIOS APLINKOS KOKYBĖS ANALIZĖ IR INTEGRUOTAS VERTINIMAS

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